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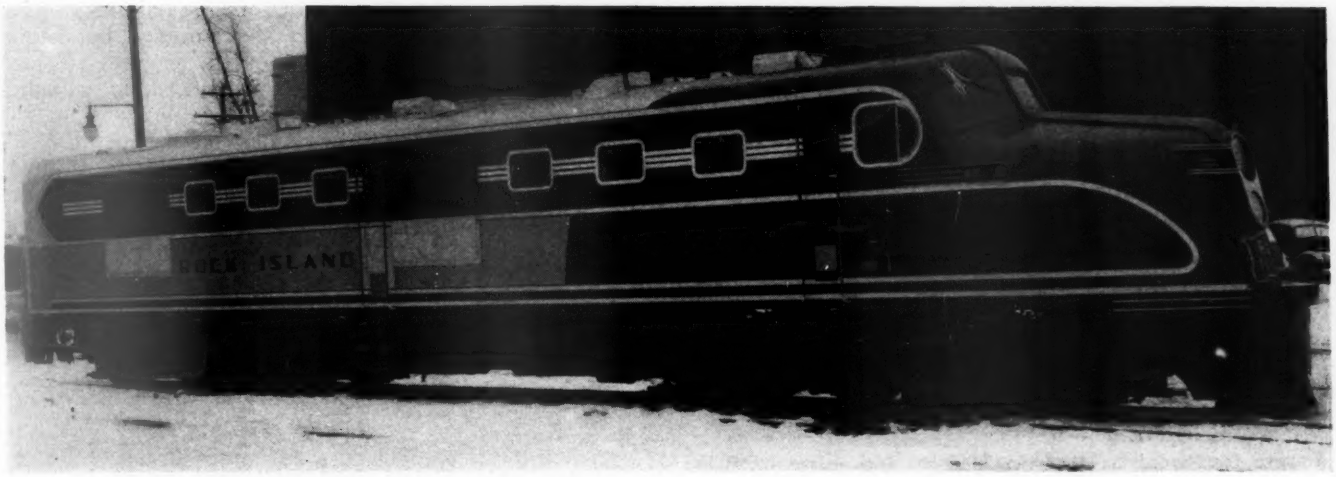
**RAILWAY
MECHANICAL ENGINEER**



Rock Island Buys Alco-G.E.

2,000-Hp. Road Locomotives

Passenger motive power designed for 120 m. p. h. has six-wheel trucks and a total weight of 330,000 lb.—Tractive force, 53,000 lb.

THE American Locomotive Company recently delivered to the Chicago, Rock Island & Pacific two Alco-G. E. 2,000-hp. road passenger locomotives for service on the "Arizona Limited" between Chicago and Tucumcari, Ariz. These locomotives are each powered by two 1,000-hp. Alco turbo-charged Diesel engines and are equipped with electric generating, traction and control equipment built by the General Electric Company. The locomotives have six-wheel trucks and are designed for a maximum speed of 120 m. p. h. The total weight is 330,000 lb. and the starting tractive force, at 24 per cent adhesion, is 53,000 lb.

Construction Details

The general structure of these locomotives consists of a welded steel underframe on cast-steel, six-wheel trucks with a cab having a sloping front end and a conventional passenger-car-type vestibule at the rear end. The air brake and train-control equipment is located under the low hood at the forward end and this space is entered through a door from the operator's compartment. The latter compartment, 7 ft. 6½ in. long, has exterior doors at both sides of the locomotive and doors on both sides leading into the engine compartment.

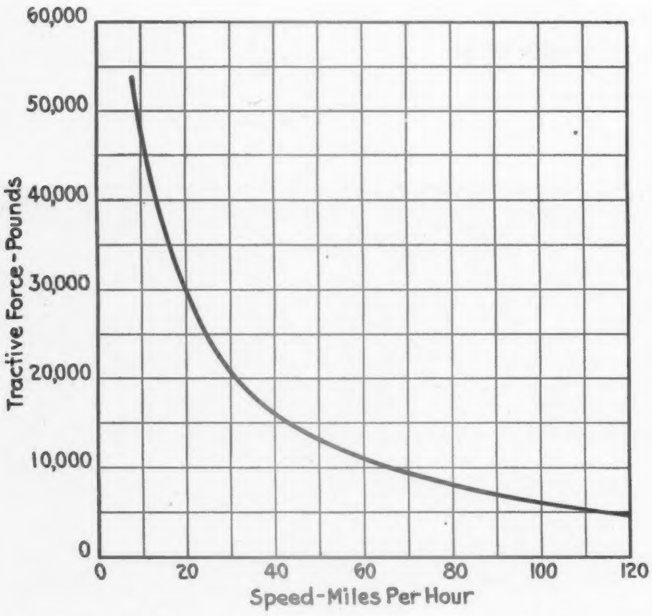
The two engines are located on the center line of the locomotive with the main and auxiliary generators and turbo-chargers at the forward end of each engine and the air compressors and radiator ventilating fans at the rear end of each engine set. The engine compartment is approximately 47 ft. long. Two Vapor Clarkson 1,600-lb. per hr. steam generators for train heating are located at the left side of the rear end of the cab. A radiator chamber is located at the rear of each engine and is arranged with two standard 11-section radiators, one on each side of the locomotive. Each engine and its cooling equipment is an individual unit. The cooling is accomplished by drawing air into the radiators in the side of the locomotive and discharging it from the roof. The 54-in. radiator fans are located in funnels just under the roof to which the radiator plenum chambers are connected. A total of 17 radiator sections are used for cooling engine water and 5 sections for cooling lubricating oil. Each radiator is equipped with manually-operated shutters.

Ventilators are located in the roof of the engine compartments to provide cool air for the engine, traction blowers, boilers, etc., and to discharge heated air from the engine room.

Underframe and Cab

The underframe is of welded construction employing standard rolled sections. The center sills are H-beams 12 in. deep with bolsters of plate and I-beam construction forming a rigid box section. The center plates and draft-gear housings are steel castings, the former being welded to the underframe and the latter riveted. The center plates are protected from wear by steel liners lubricated from oil cups located in the engine compartment.

The cab framing is of truss design, welded throughout, using standard rolled sections. The cab roof is of semi-elliptic cross sections framed of rolled sections welded



Tractive force-speed curve of the 2,000-hp. Rock Island locomotive

together and riveted to the side frames. Hatchways are provided in the roof for the removal of engines, generators and train heating boilers. The main hatches also have smaller openings with hinged covers as a means of access for the inspection and removal of pistons.

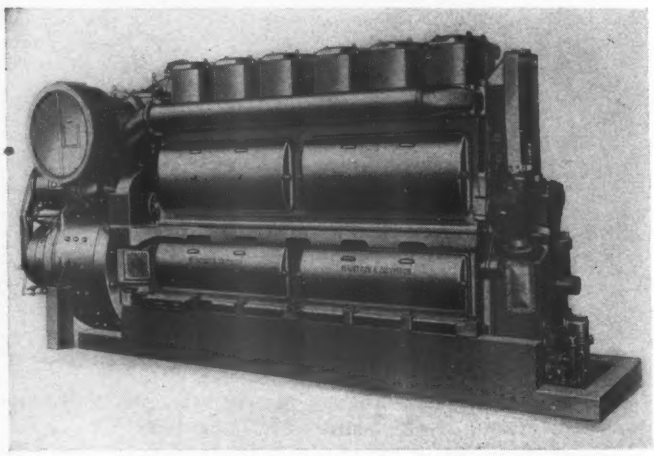
The walls and the roof of the operator's cab are lined inside with metal sheathing and the space between this sheathing and the outer covering is filled with insulating material. The bulkhead between the operator's cab and the operator's compartment is an insulated wall. All of the cab doors are of metal construction or metal covered. In addition to the two side exit doors in the operator's compartment there are side exit doors at the approximate center of the engine compartment.

The windows across the front of the operator's cab and in the side walls of the engine compartment are the fixed type with rubber weather seals. The side windows of the operator's cab are the combination type with a controlled drop section and a front section hinged for ventilation. All window frames are of metal construction and all windows are fitted with safety glass. There are window wipers, defrosters, and sun visors for both front windows.

The Diesel Engines

The locomotive is powered by two Alco six-cylinder, vertical, four-cycle, turbo charged* Diesel engines developing 1,000-hp. at normal running speed of 740 r. p. m. These engines have a bore of 12½ in. and a stroke of 13 in. The engine base is cast aluminum alloy. In basic design, these engines are identical to the engines used in Alco-G. E. switching locomotives. However, because of the higher average load factor of the engines in road service, a different cylinder head is used which embodies slightly larger valves and larger port areas than the cylinder head used on the switcher engine. At the full load of the engine, the turbo-chargers operate at moderate speeds, approximately 30 per cent below their normal designed speed. The use of cast aluminum engine bases on the engines for the road locomotive is for the purpose of reducing weight.

Another point of difference in these engines is the built-in air-brake compressor. In co-operation with the


One of the turbo-charged 1,000-hp. Alco Diesel engines showing the generators and two-stage compressor

Westinghouse Air Brake Company, a two-cylinder two-stage compressor was developed for direct attachment to the end of the engine opposite the generator. There is

* A detailed description of the Alco (Buchi System) turbo-charger appeared in the *Railway Mechanical Engineer* for August, 1937, page 339 and the results obtained with this system of supercharging were summarized in the August, 1938, issue, page 297.


A shop view of one of the six-wheel trucks and a cab under construction in the background

a crankshaft extension bolted to the end of the Diesel engine crankshaft for the compressor cylinder connecting rods. The intercooler for this compressor is mounted on the end of the engine above the compressor itself. This compressor has a displacement of 114 cu. ft. per min. at full engine speed or a total of 228 cu. ft. per min. for both compressors. The engine lubricating oil pump is mounted inside this air-brake compressor crankcase and is driven from the crankshaft extension.

Provision is made by the extension of this crankshaft beyond the compressor for the V-belt pulleys which drive the radiator fan for each engine and the traction-motor blower fan in the case of the No. 2 engine. On the No. 1 engine this fan is driven by an extension of the generator shaft.

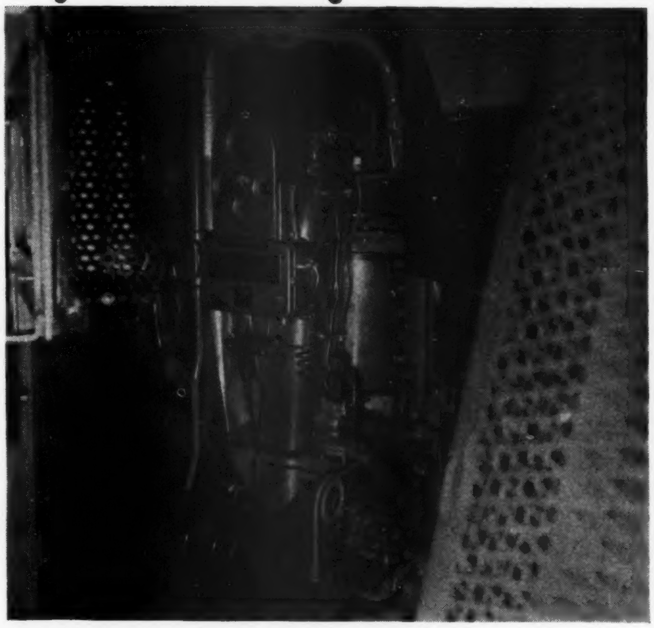
Electrical Equipment

Capacity ratings of the electric-drive equipment have been made ample to meet all service requirements. Several improvements have been incorporated in the design including a special control for maintaining the engine load.

Each of the two engines drives a direct-connected main generator, an auxiliary generator, mounted on an extension of the shaft of the main generator, and a split-pole exciter mounted on the top of the auxiliary generator. The main generator has ample capacity to convert the available output of the engine and a special feature is incorporated in the form of a speed switch mounted on the end of the exciter shaft which keeps the engine fully loaded regardless of altitude, temperature or other variable conditions.

General Characteristics of Rock Island 2,000 Hp. Diesel-Electric Road Locomotives

Total engine brake horsepower (for traction)	2,000
Driving motors, number	4
Maximum speed restriction, m.p.h.	120
Driving wheels, (four pairs) diameter, in.	40
Idling wheels, (two pairs) diameter, in.	40
Wheel base, truck, rigid, ft.-in.	15-4
Wheel base, total locomotive, ft.-in.	58-4
Weights:	
On driving wheels, lb.	220,000
On idling wheels, lb.	110,000
Total locomotive, lb.	330,000
Maximum overall dimensions:	
Height, roof, ft.-in.	13-6
Height, maximum, ft.-in.	14-4
Width, inside cab sheets, ft.-in.	9-9
Width, maximum, ft.-in.	10-6
Length, overall, ft.-in.	74-9¼
Starting tractive force, (at 24 per cent adhesion), lb.	53,000
Maximum radius curvature, deg.	21
Lubricating oil capacity, per engine, gal.	80
Fuel oil capacity, total, gal.	1,200
Engine cooling water capacity, per engine, gal.	325
Boiler water capacity, gal.	1,000
Sand capacity, cu. ft.	20

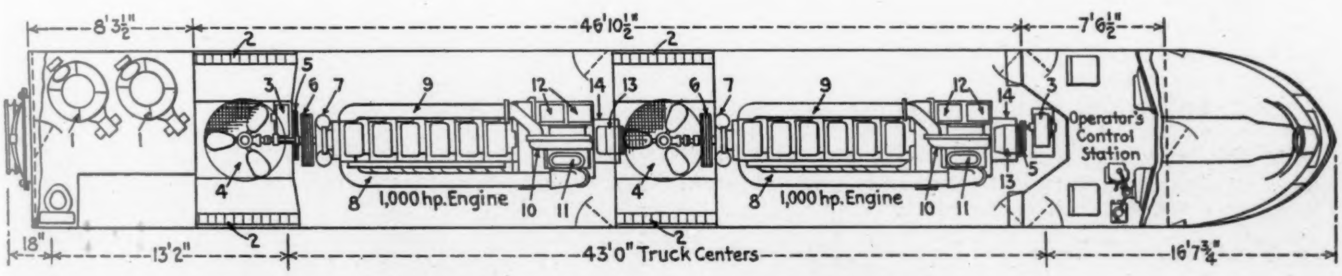


The two steam generators

The auxiliary generator has a rating of approximately 11 kw., and supplies power to control circuits, lighting circuits and all auxiliaries that are electrically operated as well as power for charging the 32-cell, KT 35, Exide battery having an eight-hour rating of 291 amp.-hr. The armature is mounted on the main generator shaft extension and the frame of the generator is bolted to the main generator bearing bracket. The auxiliary circuit voltage is held constant at 75 volts throughout the speed range of the engine by a voltage regulator.

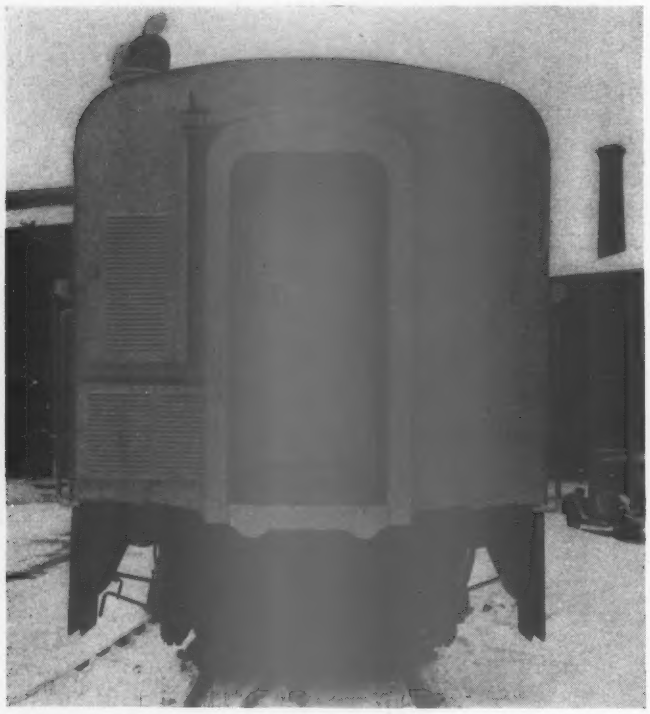
The exciter which furnishes excitation for the main generator is mounted on the top of the generator frame and is belt driven from the main engine shaft. This exciter is a split-pole machine with a special magnetic circuit which maintains generator horsepower constant throughout the normal speed range of the locomotive.

Current from the two main generating plants is supplied to four GE-730 single-geared traction motors of the conventional four-pole, commutating-pole design. Constant oil level bearings are used for the axle bearings. A feature of this equipment is the forced oil lubrication of the gear and pinion. By use of an oil-tight and dust-tight gear case and special construction of the gear and pinion, a constant stream of fresh oil is supplied at the point of contact by forcing out the lubricant through holes in the gear rim. The gear rim is a separate part



1—Steam generator
2—Radiators
3—Traction motor blowers
4—Radiator fans
5—Belt drive for motor blower
6—Belt drive for radiator fan
7—Two-stage air compressor
8—Exhaust manifold
9—Intake manifold
10—Turbo-charger blower
11—Turbo-charger exhaust
12—Air inlet for turbo-charger
13—Exciter
14—Auxiliary generator

Plan of Alco-G. E. 2,000-hp. Diesel-Electric locomotive for the Rock Island



At the rear end is a standard passenger-car vestibule

bolted to the hub so as to eliminate distortion and maintain the teeth in shape and correct alinement. Both armature bearings are of the roller type and the armatures are dynamically balanced. Both the bearings and shafts are made unusually large to allow an adequate safety factor. The gearing (58/25) permits a maximum safe speed of the locomotive of 120 m. p. h.

The conventional control for locomotives of this type is so arranged that there are two completely independent power plants from each of which two motors are first started in series, then transferred to parallel and from parallel to reduced field connection. Provision is also made for the operation of locomotives of this type in multiple.

Power supply is regulated in eight steps by the controller handle at the engineer's position. The motor connections on each power plant are changed automatically to the several operating positions. These connections are controlled by relays which effect the transfer of connections not only at reduced speed but over the entire range of operation. These relays also disconnect the field-shunting contactors if the locomotive speed drops to a point below the predetermined range for shunt-field operation.

Direction of movement of the locomotive is controlled by a small reverse handle in the master controller. This has three positions, forward, off and reverse. Wheel-slipping relays operate an indicating lamp to warn the engineer of wheel slipping while the motors are operating in series, and prevent transferring to parallel operation while this condition exists. These lights also flash momentarily during transfer to parallel to give indication of the operation on each power plant.

Trucks, Draft Gear and Brake Equipment

The trucks under these locomotives are six-wheel pedestal-type trucks with one-piece cast-steel frames, side equalizers, coil springs and swing bolsters carried by semi-elliptic springs at four corners. The trucks are arranged for the application of motors to the end axles, the middle axle being an idler. The motors are ventilated through the truck center plates. The wheel and

Partial List of Material and Equipment on the Rock Island 2,000 Hp. Road Locomotives

Conduit (aluminum)	Aluminum Co. of America, Pittsburgh, Pa.
Electrical equipment	General Electric Company, Schenectady, N. Y.
Storage battery (Exide)	Electric Storage Battery Co., Philadelphia, Pa.
Soundproofing; Burgess acoustic	Pyle-National Company, The, Chicago
Pipe covering	Union Asbestos & Rubber Co., Chicago
Radiator fans	General Electric Company, Schenectady, N. Y.
Shutters	Kysor Heater Co., Cadillac, Mich.
Air-compressor strainers; air-compressor intercooling units	Westinghouse Air Brake Co., Wilmerding, Pa.
Motor trucks	General Steel Castings Corp., Eddystone, Pa.
Truck wheels, rolled steed	Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Roller bearings; roller-bearing heat indicator	The Timken Roller Bearing Co., Canton, Ohio
Springs	American Locomotive Co., Railway Steel Spring Div., New York
Couplers; Coupler yokes; draft gear	National Malleable and Steel Castings Co., Cleveland, Ohio
Truck, clasp, brake	American Steel Foundries, Chicago
Brake, operating; slack adjuster; brake cylinders, aluminum	Westinghouse Air Brake Co., Wilmerding, Pa.
Brake shoes	American Brake Shoe & Foundry Co., New York
Hand brake	National Brake Co., Buffalo, N. Y.
Cab doors	The Morton Mfg. Co., Chicago
Cab doors	Haskelite Mfg. Corp., Chicago
Tread plate, aluminum; partition plates	Aluminum Co. of America, Pittsburgh, Pa.
Vestibule diaphragm	The Morton Mfg. Co., Chicago
Vestibule buffer spring	Standard Railway Equipment Mfg. Co., Chicago
Operator's compartment, drop sash; window glass moulding	O. M. Edwards, Inc., Syracuse, N. Y.
Operating compartment seats	Heywood-Wakefield Co., Gardner, Mass.
Vestibule curtain	The Adams & Westlake Co., Elkhart, Ind.
Train steam heat equipment	Vapor Car Heating Co., Inc., Chicago
Air horns	Westinghouse Air Brake Co., Wilmerding, Pa.
Speed indicator	General Electric Company, Schenectady, N. Y.
Side-wall panels	Haskelite Mfg. Corp., Chicago
Insulation	Johns-Manville Sales Corp., New York
Sanders	Graham-White Sander Corp., Roanoke, Va.
Headlight; classification-lamp lens	The Pyle-National Company, Chicago
Dome lamp	Safety Car Heating & Lighting Co., New York
Classification lamp	American Locomotive Co., New York
Paint	E. I. duPont deNemours, Wilmington, Del.

axle assembly can be removed with or without the motors. The truck wheels are 40 in. diameter mounted on axles of open-hearth steel with 7-in. journals carried in Timken roller bearings. Clasp brakes are used on all wheels. Automatic and straight-air brakes are applied to all wheels. The operating brake schedule is Westinghouse HSC.

The locomotives are equipped with National M-350-A draft gear and National tight-lock couplers, front and rear. The coupler at the front end is the concealed swivel type.

The controls at the engineman's station

Twenty-Ninth Annual

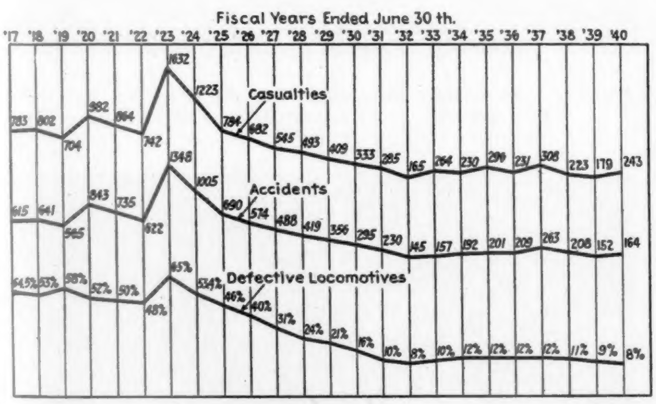
Locomotive Inspection Report

Number of casualties and accidents increase although condition of steam locomotives improves as the percentage of defective locomotives equals record low of eight in 1932

The annual report of the Bureau of Locomotive Inspection, Interstate Commerce Commission, submitted by John M. Hall, director, covering the fiscal year, ended June 30, 1940, shows that eight per cent of the steam locomotives inspected were found defective, a decrease of one per cent as compared with the previous year. However, the 164 accidents, resulting in 18 deaths and 225 injuries, which occurred in connection with steam locomotives, represents an increase of 12 accidents, an increase of three in the number of deaths and an increase of 61 in the number of persons injured as compared with the previous year.

The accompanying chart shows the percentage of defective steam locomotives, the number of accidents and the number of casualties for the years ended June 30, 1917, to 1940, inclusive. Summaries and tables included in the report show separately accidents and other data in connection with steam locomotives and tenders and their appurtenances and similar data for locomotives other than steam.

In addition to the accidents referred to in the report, two accidents resulting in injuries to four employees caused by explosions of torpedoes carried in metal containers attached to the backboards inside of the locomotive cabs, were reported to the Bureau by widely separated railroads. These accidents and two other explosions due to the same cause on one of the railroads, in which no injuries occurred, do not come within the scope of the locomotive inspection law but are mentioned in the report to emphasize the need for clean smooth-surface containers with the explosives properly placed therein and packaged so the contents will not leak out.



Relation of defective steam locomotives to accidents and casualties

Reports were filed for 44,274 locomotives during the year ended June 30, 1940, a decrease of 1,691 compared with the previous year. Of the 102,164 locomotives inspected, 8,565 were found defective and 487 were ordered out of service. For the previous year, 105,606 steam locomotives were inspected, 9,099 were found defective and 468 were ordered out of service. In the year ended June 30, 1938, 11,050 of the 105,186 steam locomotives inspected were found to be defective and 679 were ordered out of service. The total number of defects found and shown in the last three reports were 32,677 in 1940, 33,490 in 1939, and 42,214 in 1938.

Table I shows the number of casualties resulting from steam locomotive accidents classified according to occupation. Table II shows the parts found defective on steam locomotives and gives data on inspections and reports. Similar data for locomotives other than steam are given in Table III.

During the last fiscal year, eight boiler explosions occurred in which 12 persons were killed and 15 were injured. All of these explosions were caused by overheating of the crown sheet due to low water. Boiler and appurtenance accidents, other than explosions, resulted in the death of four persons and injuries to 95.

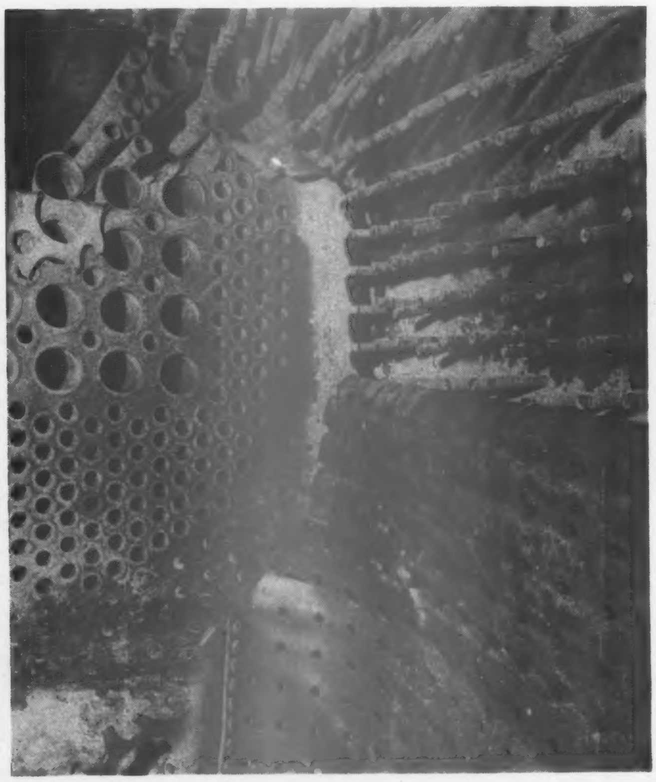
Locomotives Other Than Steam

For locomotives other than steam, reports were filed covering 2,987 locomotives in the year ended June 30,

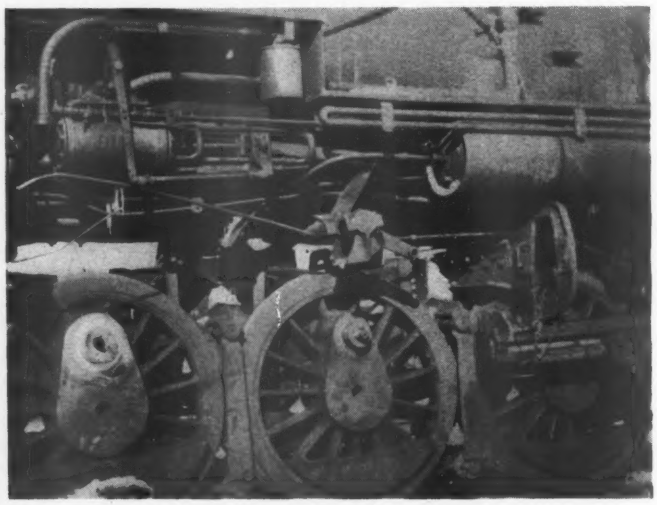
Table I—Number of Casualties Classified According to Occupation—Steam Locomotive Accidents

	Year ended June 30									
	1940		1939		1938		1937		1936	
	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured	Killed	Injured
Members of train crews:										
Enginemen	5	70	4	46	3	70	8	106	4	75
Firemen	6	49	6	66	2	80	5	78	6	72
Brakemen	4	24	2	18	...	31	3	30	3	28
Conductors	1	4	...	5	...	6	1	18	...	13
Switchmen	...	4	...	6	...	7	...	10	...	2
Roundhouse and shop employees:										
Boilermakers	1	3	1	1	...	2	2	2	...	...
Machinists	...	3	...	2	...	...	...	2	...	4
Foremen	...	...	...	...	...	1	...	...	...	3
Inspectors	...	...	...	...	...	1	...	...	...	2
Watchmen	...	1	...	1	2	...	1	1	1	1
Boiler washers	...	...	...	...	...	1	...	...	...	...
Hostlers	...	2	...	1	...	6	...	9	...	3
Other roundhouse and shop employees	...	1	...	2	...	1	...	3	...	3
Other employees	1	20	...	2	...	3	1	14	...	5
Nonemployees	...	44	2	14	...	7	4	10	2	4
Total	18	225	15	164	7	216	25	283	16	215

The overturned running gear and tender, damaged truck and two of six derailed passenger cars after a boiler explosion due to low water



Firebox interior of the locomotive shown above after the explosion—Two employees were killed and eight persons were seriously injured



A broken main crankpin that failed while the locomotive was hauling a freight train at an estimated speed of 45 m.p.h.

A boiler tube that failed at a safe-end weld near the back flue sheet due to overheating at the time the weld was made

A crack in a main driving wheel that originated in fusion welding applied previously in an attempt to repair a crack of lesser extent

1940, an increase of 271 over the previous year. A total of 298, or six per cent of the 4,974 locomotive units inspected were found defective and 16 were ordered out of service. This is an increase of 38 in the number found defective, an increase of two in the total ordered out of service and no change in the percentage found defective.

Both the number of accidents occurring in connection with locomotives other than steam and the number of persons injured in these accidents increased from 5 to 7. No deaths occurred in either year.

Table II—Number of Steam Locomotives Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1940	1939	1938	1937	1936	1935
1—Air compressors	567	518	689	766	740	733
2—Arch tubes	20	28	66	105	74	74
3—Ashpans and mechanism	37	67	72	80	79	94
4—Axles	3	2	13	10	13	10
5—Blow-off cocks	191	204	226	199	236	283
6—Boiler checks	288	279	301	382	356	413
7—Boiler shell	266	272	331	347	383	396
8—Brake equipment	1,506	1,577	2,044	2,322	2,480	2,449
9—Cabs, cab windows, and curtains	1,078	943	1,226	1,807	1,638	1,273
10—Cab aprons and decks	277	260	326	466	450	368
11—Cab cards	101	92	109	145	166	142
12—Coupling and uncoupling devices	53	60	73	74	65	73
13—Crossheads, guides, pistons, and piston rods	815	739	905	1,160	1,056	1,086
14—Crown bolts	54	47	59	76	63	75
15—Cylinders, saddles, and steam chests	1,320	1,232	1,645	2,206	1,717	1,547
16—Cylinder cocks and rigging	447	418	585	729	605	627
17—Domes and dome caps	78	90	109	101	114	94
18—Draft gear	508	450	740	522	513	423
19—Draw gear	306	360	479	560	451	414
20—Driving boxes, shoes, wedges, pedestals, and braces	1,243	1,330	1,688	1,637	1,712	1,573
21—Firebox sheets	191	238	244	371	295	343
22—Flues	147	165	159	225	178	173
23—Frames, tail pieces, and braces, locomotive	665	708	1,001	1,053	997	1,006
24—Frames, tender	78	71	131	120	113	124
25—Gages and gage fittings, air	132	155	230	261	257	275
26—Gages and gage fittings, steam	211	226	279	324	350	320
27—Gage cocks	400	361	451	538	579	480
28—Grate shakers and fire doors	273	252	403	470	400	394
29—Handholds	333	349	405	510	502	464
30—Injectors, inoperative	30	26	26	38	40	39
31—Injectors and connections	1,330	1,457	1,784	2,020	2,085	2,035
32—Inspections and tests not made as required	6,218	6,645	8,204	9,638	9,005	8,344
33—Lateral motion	313	243	325	446	404	389
34—Lights, cab and classification	49	50	48	90	78	81
35—Lights, headlight	180	177	257	313	251	257
36—Lubricators and shields	185	200	212	254	255	191
37—Mud rings	213	248	203	272	237	241
38—Packing nuts	418	408	448	487	508	527
39—Packing, piston rod and valve stem	660	739	913	1,393	1,133	906
40—Pilots and pilot beams	140	104	154	133	178	152
41—Plugs and studs	156	179	238	238	236	167
42—Reversing gear	320	317	404	492	463	414
43—Rods, main and side, crank pins, and collars	1,199	1,293	1,669	2,348	2,093	1,826
44—Safety valves	61	97	125	132	125	100
45—Sanders	415	432	536	655	678	779
46—Springs and spring rigging	2,174	2,340	2,901	3,172	3,008	2,765
47—Squirt hose	50	75	94	133	134	113
48—Stay bolts	227	181	211	276	279	240
49—Stay bolts, broken	271	258	380	542	520	512
50—Steam pipes	255	285	410	446	526	463
51—Steam valves	106	115	141	165	227	212
52—Steps	449	490	631	678	615	640
53—Tanks and tank valves	768	837	955	1,009	877	913
54—Telltale holes	95	58	67	79	127	102
55—Throttle and throttle rigging	647	638	685	909	760	733
56—Trucks, engine and trailing	598	628	762	785	861	811
57—Trucks, tender	705	665	907	1,018	1,108	1,120
58—Valve motion	506	554	722	798	824	799
59—Washout plugs	478	487	626	598	714	679
60—Train-control equipment	2	5	11	12	6	4
61—Water glasses, fittings, and shields	753	690	915	1,049	1,118	951
62—Wheels	554	466	577	803	790	697
63—Miscellaneous—Signal appliances, badge plates, brakes (hand)	564	610	684	759	608	563
Total number of defects	32,677	33,490	42,214	49,746	47,453	44,491

	Year ended June 30					
	1940	1939	1938	1937	1936	1935
Locomotives reported	44,274	45,965	47,397	48,025	49,322	51,283
Locomotives inspected	102,164	105,606	105,186	100,033	97,329	94,151
Locomotives defective	8,565	9,099	11,050	12,402	11,526	11,071
Percentage of inspected found defective	8	9	11	12	12	12
Locomotives ordered out of service	487	468	679	934	852	921

Extension of Time for Removal of Flues

Applications filed for extensions of time for removal of flues, as provided in Rule 10, totaled 1,127. The investigations of the Bureau disclosed that in 85 of these cases, the conditions of the locomotives were such that extensions could not properly be granted. The condition of 35 locomotives were such that the full extensions requested could not be authorized, but extensions for shorter periods of time were allowed. Requests for 47 extensions were granted after defects disclosed by the Bureau's investigations were repaired. Twenty-seven applications were cancelled for various reasons. Requests were granted for the full period in 933 cases.

Under Rule 54 of the Rules and Instructions for Inspection and Testing of Steam Locomotives, 187 specification cards and 4,449 alteration reports were filed, check and analyzed.

Under Rules 328 and 329 of the Rules and Instructions for Inspection and Testing of Locomotives Other Than Steam, 335 specifications and 103 alteration reports were filed for locomotive units and 87 specifications and 35 alteration reports were filed for boilers mounted on locomotives other than steam.

No formal appeal by any carrier was taken from the decisions of any inspector during the year.

Table III—Number of Locomotives Other Than Steam Reported, Inspected, Found Defective, and Ordered from Service

Parts defective, inoperative or missing, or in violation of rules	Year ended June 30					
	1940	1939	1938	1937	1936	1935
Air Compressors	8	14	6	6	2	5
Axles, truck and driving	...	1	5	4	6	1
Batteries	1	1	1	4	...	7
Boilers	10	6	6	5	5	3
Brake equipment	50	50	74	97	66	46
Cabs and cab windows	22	36	25	51	30	33
Cab cards	13	18	11	25	...	...
Cab floors, aprons, and deck plates	17	13	8	17	10	6
Controllers, relays, circuit breakers, magnet valves, and switch groups	16	13	7	8	...	...
Coupling and uncoupling devices	6	4	4	3	...	...
Current-collecting apparatus	1	5	8	4	16	3
Draft gear	31	17	23	28	24	21
Draw gear	2	4	3	1	1	...
Driving boxes, shoes, and wedges	29	52	16	14	5	5
Frames or frame braces	12	9	37	5	15	4
Fuel system	51	35	47	152	44	15
Gages or fittings, air	1	6	11	1	6	4
Gages or fittings, steam	2	...	...	...	...	...
Gears and pinions	1	2	2	2	...	...
Handholds	6	8	13	11	8	3
Inspections or tests not made as required	207	185	204	237	186	124
Insulation and safety devices	2	4	13	13	20	15
Internal-combustion engine defects, parts and appliances	35	32	26	50	23	4
Jack shafts	7	6	1	...	1	...
Jumpers and cable connectors	...	1	1	2	...	...
Lateral motion, wheels	5	1	...	1	2	...
Lights, cab and classification	1	3	2	5	6	1
Lights, headlight	3	4	4	11	4	2
Meters, volt and ampere	4	2	2	1	2	...
Motors and generators	12	19	18	10	14	5
Pilots and pilot beams	10	6	1	7	6	5
Plugs and studs	...	...	...	1	...	...
Quills	4	7	6	3	...	...
Rods, main, side, and drive shafts	2	2	2	23	2	10
Sanders	34	28	37	52	25	21
Springs and spring rigging, driving and truck	50	16	43	36	29	20
Steam pipes	4	...	5	1	2	...
Steps, footboards, etc.	22	18	23	13	...	...
Switches, hand-operated, and fuses	3	5	7	2	2	2
Transformers, resistors, and rheostats	1	1	3	...	...	1
Trucks	43	33	40	41	42	46
Water tanks	...	1	...	1	...	...
Water glasses, fittings, and shields	1	1	3	...	4	6
Warning signal appliances	...	1	3	2	1	...
Wheels	22	16	11	21	26	6
Miscellaneous	15	10	7	20	39	25
Total number of defects	766	696	769	991	674	449
Locomotive units reported	2,987	2,716	2,555	2,416	2,361	1,911
Locomotive units inspected	4,974	4,581	4,024	3,615	3,118	1,620
Locomotive units defective	298	260	274	328	252	146
Percentage inspected found defective	6	6	7	9	8	9
Locomotive units ordered out of service	16	14	9	24	11	5

Standing Locomotive Tests*

Part II

By W. F. Collins †

Selection of exhaust nozzle and comparison of test results obtained with standard and improved front-end arrangements

It is believed that the laws governing the operation of the locomotive exhaust nozzle are the same as apply to any steam nozzle. There is no question that the nozzle design of the steam turbine or the ejector nozzle has been highly refined as compared with the design of the steam locomotive nozzle. High exhaust pressure decreases the work done in the cylinders and, therefore, it is desirable to reduce the exhaust pressure without lowering the efficiency of the smokebox arrangement.

The circular exhaust nozzle without the basket bridge was tried but it was impossible to fill the large diameter stacks and obtain the higher rates of evaporation. Experiments made by varying the length of the nozzle indicated that a nozzle length over one diameter did not improve the performance but slightly increased the exhaust pressure and decreased the coefficient of discharge. A number of tests indicated that the single circular nozzle with the basket bridge gave results equal to those obtained with the multiple orifices, viz., pepper box, annular-ported, and the star-shape nozzles. For mechanical simplicity, cost, and performance the circular nozzle was considered preferable to the other designs.

Because the steam of the locomotive cylinders is exhausted to the atmosphere below and above the critical pressure, a compromise is required in the contour of the circular nozzle. Consideration must be given in the design to the use of a convergent or divergent nozzle and whether the nozzle will be under- or over-expanding. At all pressures above 11 lb. per sq. in., the exhaust steam passes through the critical pressure and the use of the divergent nozzle is desirable. At pressures below 11 lb. per sq. in., a convergent nozzle is desirable. Below 11 lb. per sq. in., the excess air is higher; above 11 lb. per sq. in., the excess air is lower than desired. An attempt is made in this design to improve combustion conditions at the upper firing rates by selecting a divergent nozzle.

Fig. 7 shows the relation of the steam flow through an ideal circular nozzle for a specific state of the exhaust steam and the development of the shape of the nozzle. Results with this nozzle are shown under the paragraph "Rates of Evaporation".

Exhaust Pressure

The results of the *A* and *B* series have been superimposed on Fig. 8 to show the relation existing between the exhaust pressure, the steam to the nozzle and the dry air supplied per hour. On the basis of dry air supplied, the *ZM* series is far superior to the *A* series. At exhaust pressures of 4, 8 and 12 lb. per sq. in., the improved front-end arrangement supplied 5,000, 12,000 and 11,000 lb. more dry air per hr. than was obtainable with the standard front-end arrangement or an increase of 10, 18.5 and 7.4 per cent, respectively.

At exhaust pressures up to about 15 lb. per sq. in., nearly 20 per cent more air was supplied during the *ZM* series, and at 20 lb. per sq. in. pressure 15 per cent more air was supplied than during the *B* series. The exhaust pressures during the *ZM* series ranged from 0.5 to 1.5 lb. per sq. in. higher than they were for the *A* series at corresponding steam rates. This increase in pressure can be attributed to the difference in efficiencies of the nozzle and exhaust pipes for the two series. The exhaust pressure during the *ZM* series with the 7⅜-in. nozzle was about 30 per cent lower than for the *B* series with the 6¾-in. nozzle and at equal rates of steam to the nozzle.

Dry Air Supplied and Used in Combustion

The dry air supplied and the theoretical dry air used for complete combustion of the coal actually burned per square foot of grate per hour are plotted in relation to the firing rate in Fig. 9. The air supplied and the air used per pound of dry coal fired have been plotted to give a clearer illustration of the air available and the air used for combustion.

The results of the *A* and *B* series have been superimposed upon this graph for ease of comparison between the series. A study of the curves will explain why it was possible to obtain better combustion with the improved front-end arrangement during test series *ZM* than could be obtained during the standard front-end arrangement test series *A* and *B*, and why it was possible to attain higher firing rates during the former series.

The dry air supplied during the *ZM* series was much greater than for the *A* series, whether based on the coal rate or the steam to the nozzle. Since the mixed smokebox gases are products of combustion, depending for the greater part on the dry air supplied, the weight of mixed smokebox gases is naturally higher for the *ZM* series than it was for the *A* series at corresponding rates. This difference in weight of gases amount to about 7,000 lb. or 14.3 per cent at 30,000 lb. of steam to the nozzle, and 12,000 lb. or 12.3 per cent at 65,000 lb. of steam to the nozzle.

At a steam rate through the nozzle of 30,000 lb. per hr. there was hardly any difference between the *ZM* and *B* series in the weight of gases moved per pound of steam, but at rates of 45,000 and 60,000 lb. per hr. the weight of gases moved per pound of steam through the nozzle during the *ZM* series was 7.0 and 6.6 per cent, respectively, higher than for the *B* series. The fact that a greater weight of gases was moved per pound of steam at a reduction in exhaust pressure of about 30 per cent indicates a decided advantage in favor of the improved front-end arrangement with a 7⅜-in. nozzle over the standard front end with a 6¾-in. nozzle, as operated in road service.

The efficiencies of heat absorption and combustion,*

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* Part II of a paper presented at the annual meeting of the Railway Fuel and Traveling Engineers' Association on October 23, 1940, at Chicago. Part I appeared in the February, 1941, issue.

† Engineer of tests, New York Central

* This is in conformity with the theory presented by Lawford H. Fry in his book, "A Study of the Locomotive Boiler," Simmons-Boardman Publishing Company, 1924.

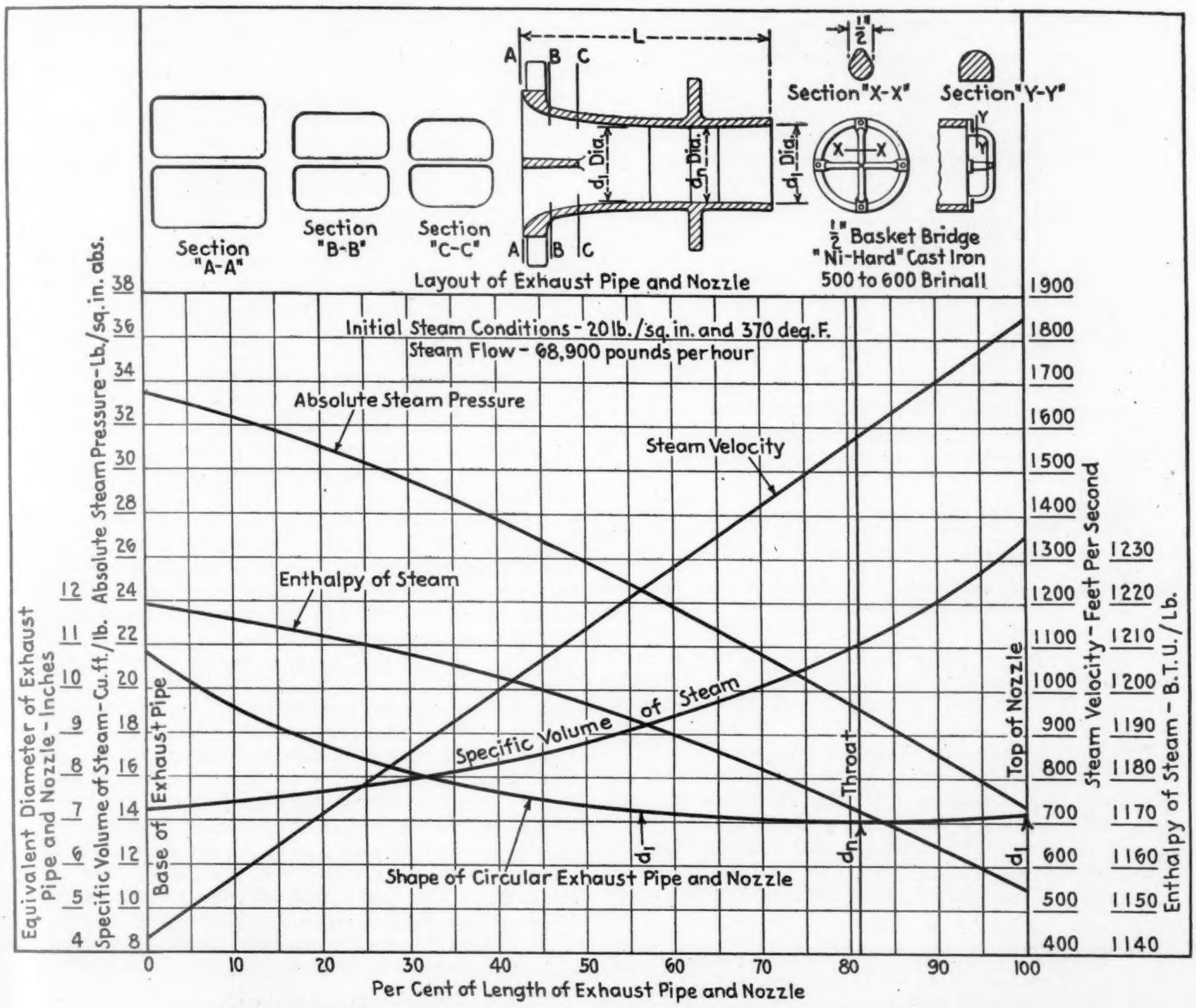


Fig. 7—Steam flow through an ideal circular nozzle for a specific state of the exhaust steam

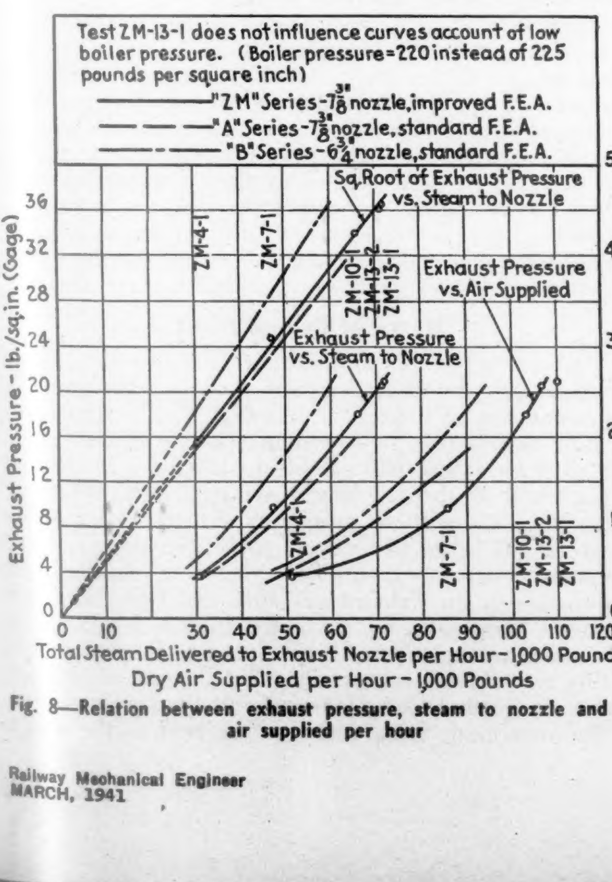


Fig. 8—Relation between exhaust pressure, steam to nozzle and dry air supplied per hour

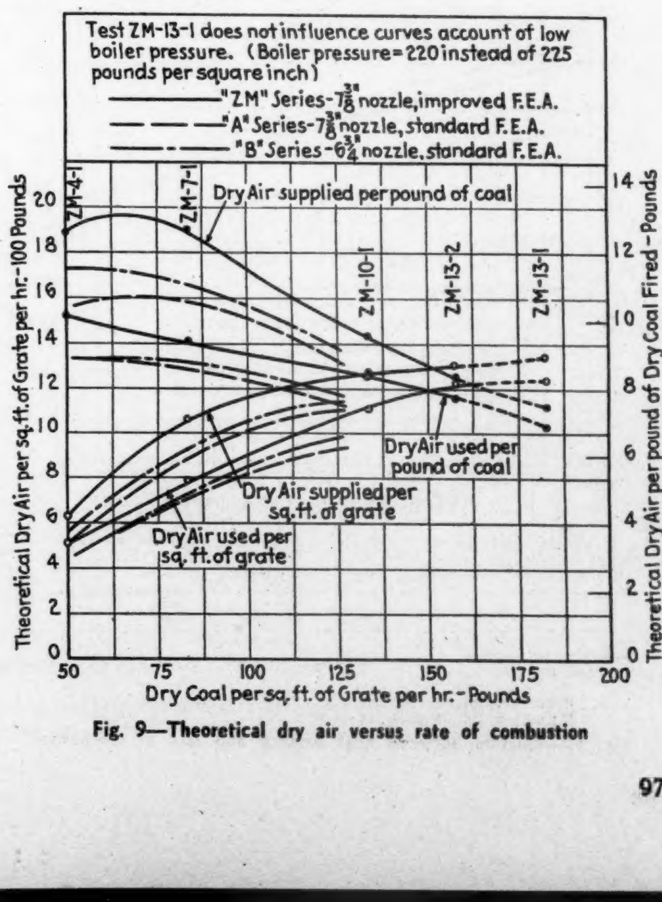


Fig. 9—Theoretical dry air versus rate of combustion

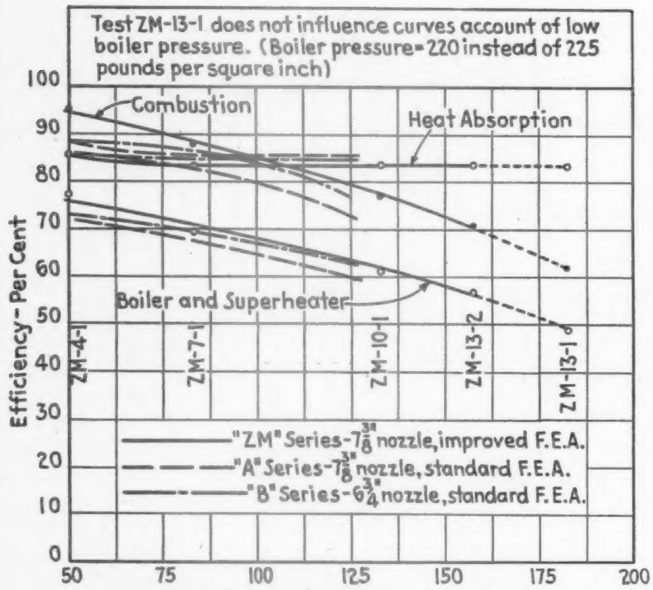


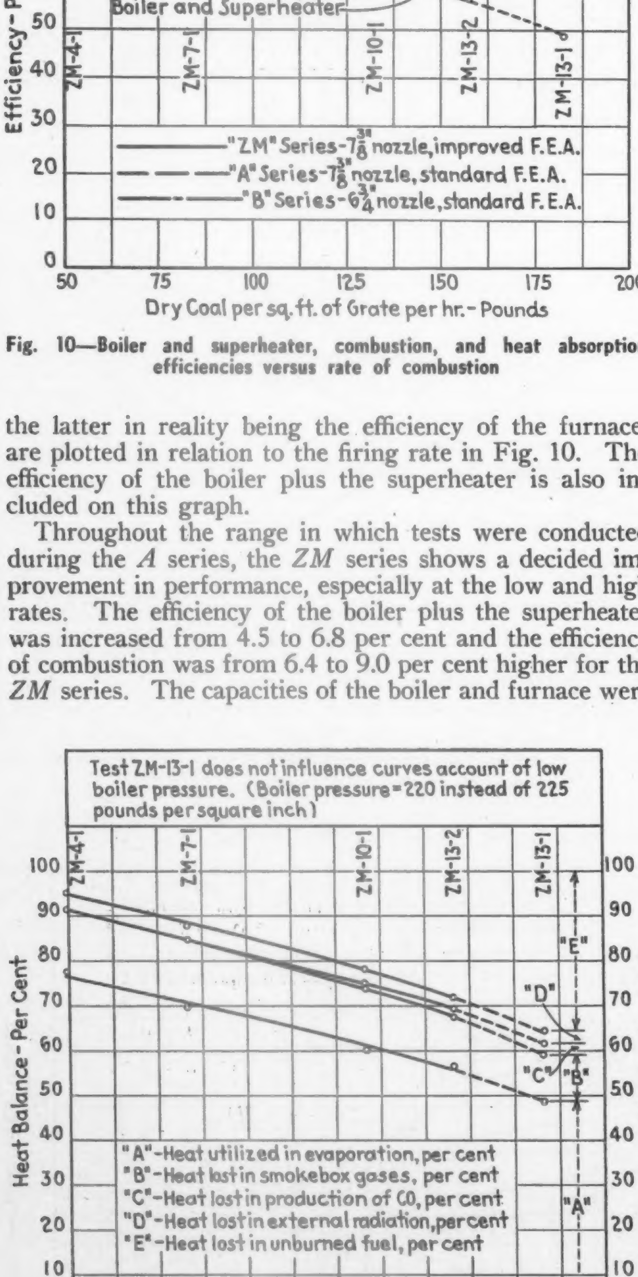
Fig. 10—Boiler and superheater, combustion, and heat absorption efficiencies versus rate of combustion

the latter in reality being the efficiency of the furnace, are plotted in relation to the firing rate in Fig. 10. The efficiency of the boiler plus the superheater is also included on this graph.

Throughout the range in which tests were conducted during the *A* series, the *ZM* series shows a decided improvement in performance, especially at the low and high rates. The efficiency of the boiler plus the superheater was increased from 4.5 to 6.8 per cent and the efficiency of combustion was from 6.4 to 9.0 per cent higher for the *ZM* series. The capacities of the boiler and furnace were increased approximately 15 to 22 per cent, respectively. The improved front-end arrangement supplied more air at normal firing rates than was obtainable with the standard front-end arrangement and sufficient air at much higher firing rates which accounts for its superiority over that design.

The results of the *ZM* series shows an improvement over those of the *B* series. The efficiency of the boiler plus the superheater was increased from 0.8 to 4.1 per cent and the efficiency of combustion for the *ZM* series was from 2.1 to 6.8 per cent higher than for the *B* series. The capacities of the boiler and furnace were increased about 12 to 14 per cent, respectively. These improvements in performance by the use of the improved front-end arrangement were obtained with a reduction in exhaust pressure of from 20 to 30 per cent at equal rates of steam to the nozzle. In road service, this reduction in exhaust pressure should result in increased engine horsepower output and with the increased combustion efficiency should result in a higher thermal efficiency of the locomotive.

The efficiency of combustion for the *ZM* series is higher than that for the *A* series while the efficiency of heat absorption is from 2 to 2½ per cent lower. Off hand, it might be assumed that the heat absorbed by the boiler during the *ZM* series was less than that absorbed during the *A* series but this is not true. The reason for the efficiency of heat absorption in per cent being lower for the *ZM* series than for the *A* series is that more air was supplied per pound of coal in the *ZM* series than in the *A* series, resulting in a greater proportion of the coal fired being burned. This increased the efficiency of combustion, which is the ratio of the heat produced in the firebox to that available in the coal fired, but the heat absorbed by the boiler does not increase in as great a proportion as the heat produced in the firebox because of the increase in the heat lost in the flue gas. Consequently, while more heat per pound of coal is absorbed by the boiler during the *ZM* series than during the *A* series, the ratio of heat absorbed to the heat produced, or efficiency of heat absorption, becomes less for the *ZM* series.



Proximate Analysis of Dry Coal	
Fixed carbon, per cent	55.26
Volatile matter, per cent	39.16
Ash, per cent	5.58
	100.00
Moisture, per cent	2.06
Sulphur, per cent	1.95

Ultimate Analysis of Dry Coal	
Carbon, per cent	78.57
Hydrogen, per cent	5.28
Oxygen, per cent	7.06
Nitrogen, per cent	1.58
Sulphur, per cent	1.93
Ash, per cent	5.58
	100.00

B.t.u. per lb. of dry coal 13,919
B.t.u. per lb. of coal, as fired 13,630

Fig. 11—Relation between heat balance and rate of combustion

Heat Balance

The heat balance has been plotted in Fig. 11 in relation to the rate of firing. The heat utilized and the heat losses are enumerated and identified on the graph; the sum total being 100 per cent. A typical analysis of the coal used during these tests is also shown with this graph.

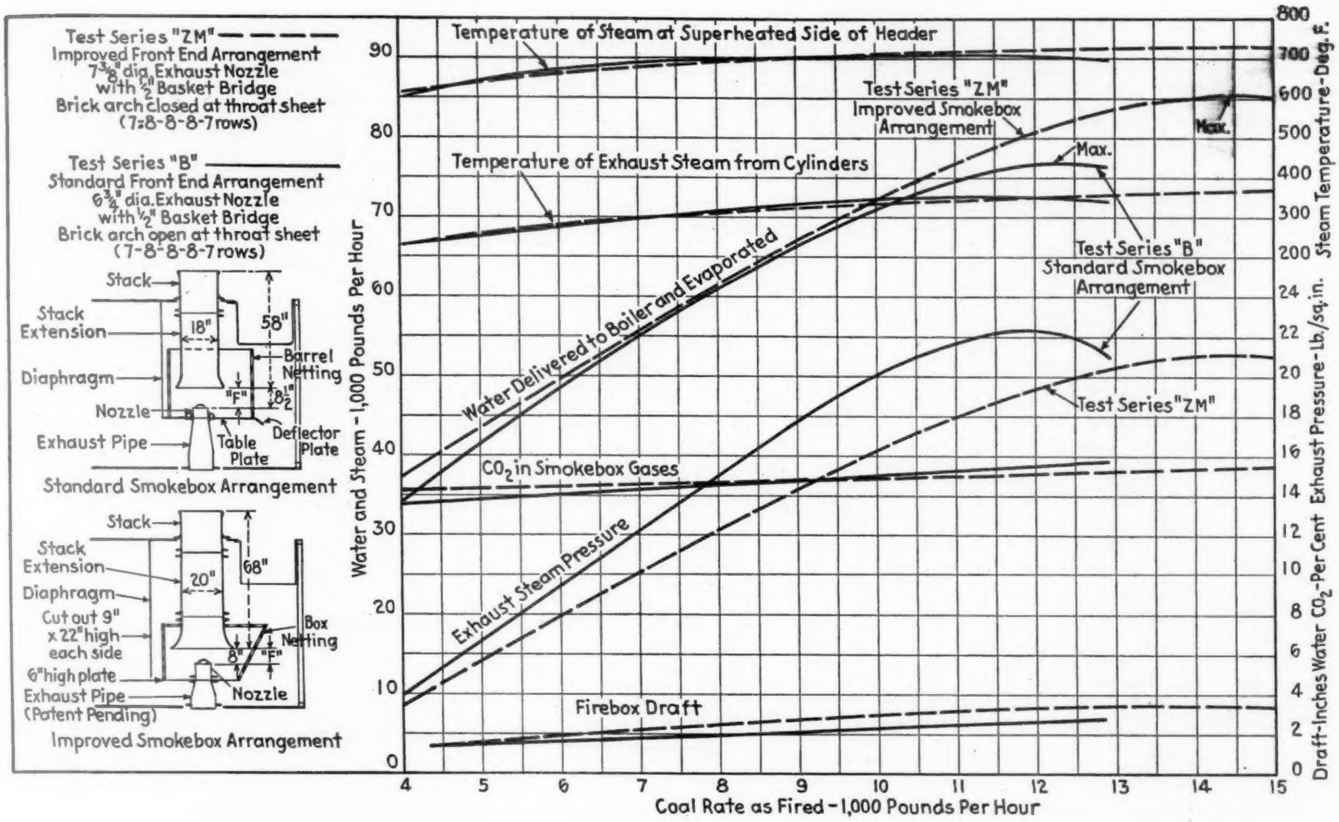
Average curves have been drawn showing the loss due to the unburned fuel and heat utilized in evaporation, but in order to show the losses due to incomplete combustion more clearly, the points affecting the heat lost in smokebox gases, radiation, and incomplete combustion have been connected by straight lines. Note the loss by unburned fuel and cinders, or so-called stack loss.

Rates of Evaporation

The summary of experiments with a conventional and an improved smokebox design is shown by the graphical representation of the test results in Fig. 12. The actual rate of evaporation is shown in relation to the rate of fuel fired for a New York Central Class J-1-b locomotive.

Sketches of the smokebox arrangements have been superimposed on these graphs as a matter of information. It will be noted that an appreciable increase in the evaporative capacity of the boiler has been obtained with a decrease in the exhaust pressure and both have been obtained principally by a change in the design of the smokebox arrangement. Some increase in performance is due to a closed-arch arrangement instead of an open-arch arrangement using toe bricks at the throat sheet.

The maximum firing rate is considered as the rate at



Locomotive Data

Cylinders, number, diameter and stroke, in.	2-25 x 28	Heating surfaces, sq. ft.:	
Driving wheels, diameter outside tires, in.	79	Tubes and flues	4,203
Boiler steam pressure, lb. per sq. in.	225	Firebox	281
Grate area, sq. ft.	81.5	Evaporative, total	4,484
Grate free air opening, per cent	22	Superheater	1,951
Fuel	Bit. coal	Combined evap. and superheater	6,435
		Volume of firebox, cu. ft.	410

Fig. 12—Summary of experiments with a conventional and an improved smokebox design in N. Y. C. Class J-1-B locomotive No. 5224

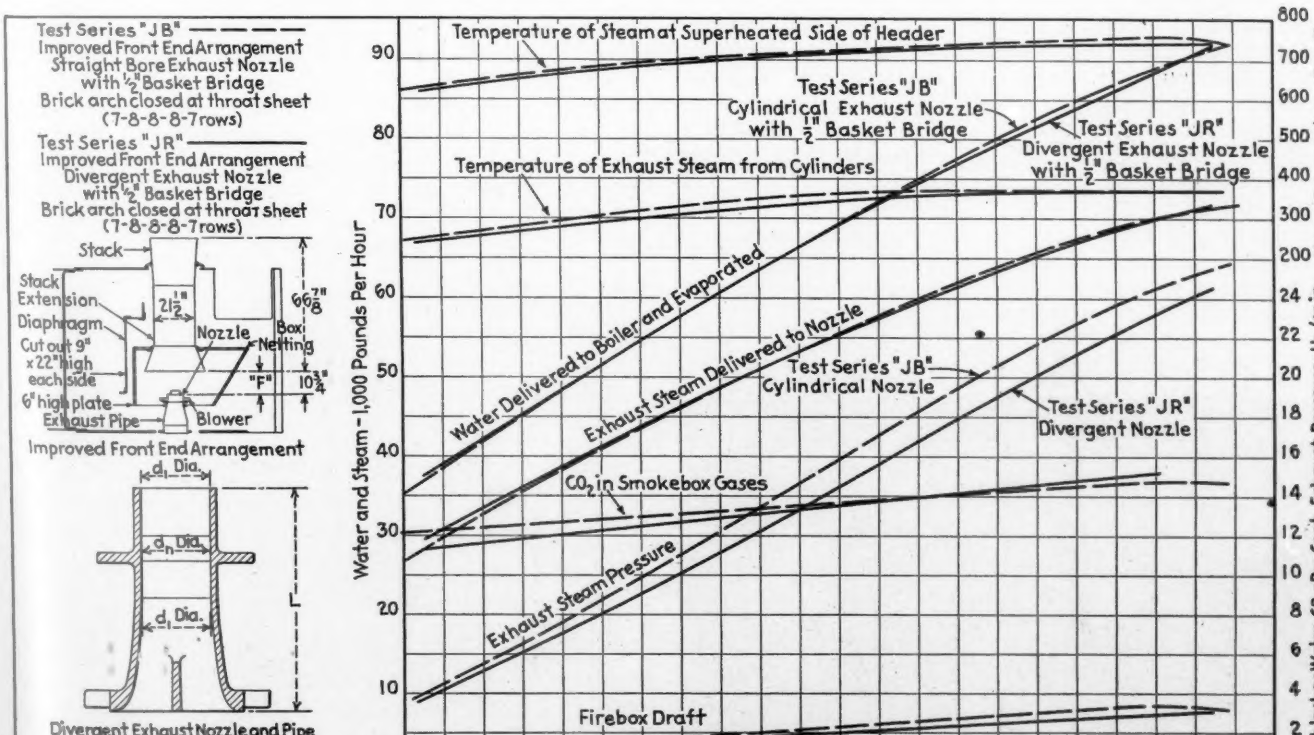
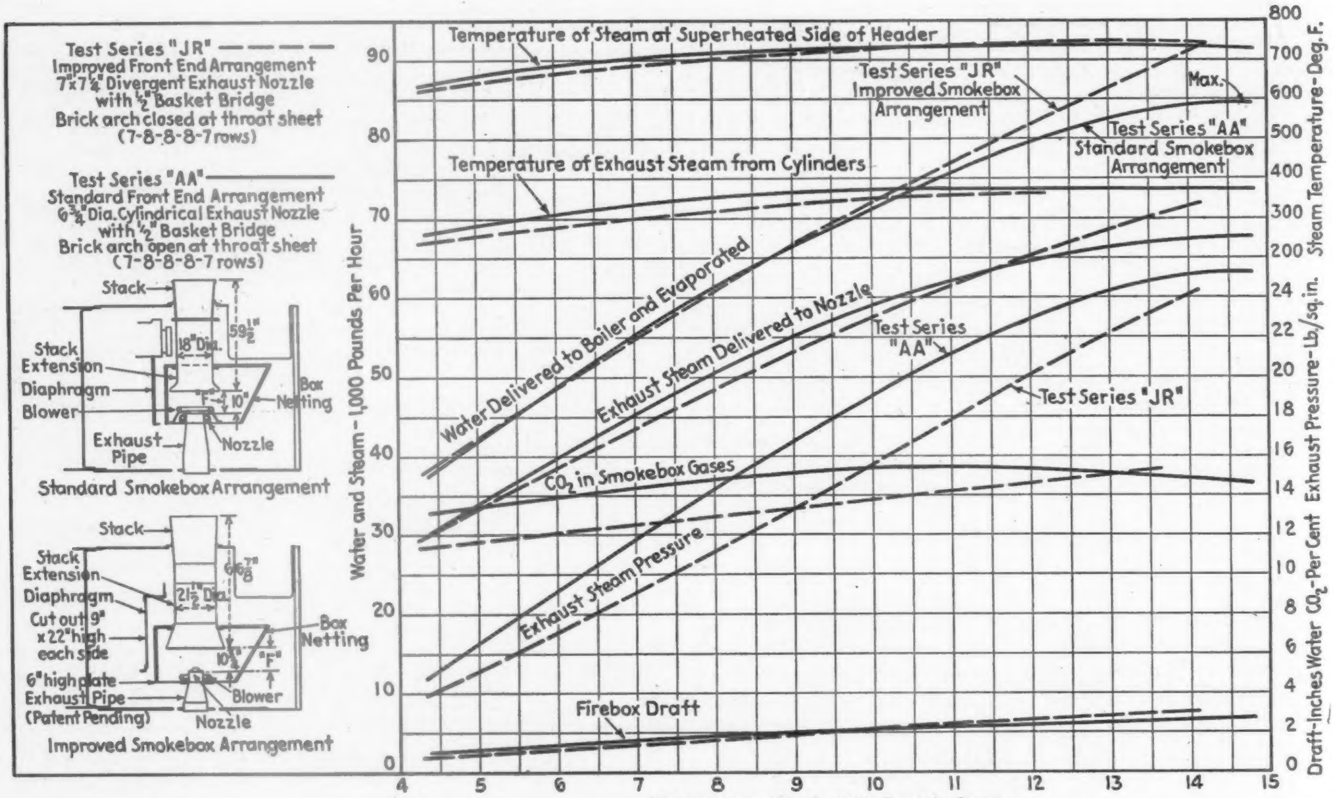


Fig. 13—Comparison of test results obtained with a straight-bore exhaust nozzle and a divergent nozzle in N. Y. C. Class J-3-A locomotive No. 5408



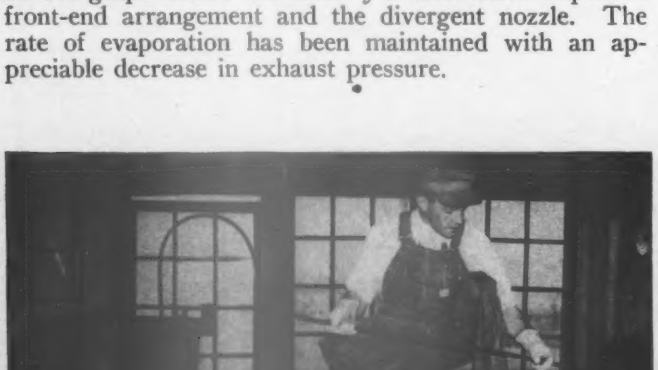
LOCOMOTIVE DATA

Cylinders, number, diameter and stroke, in.	2-22½ x 29
Driving wheels, diameter outside tires, in.	79
Boiler steam pressure, lb. per sq. in.	275
Grate area, sq. ft.	82
Grate free air opening, per cent	25
Fuel	Bit. coal
Heating surfaces, sq. ft.:	
Tubes and flues	3,827
Firebox and comb. chamber	360
Evaporative, total	4,187
Superheater	1,745
Combined evap. and superheater	5,932
Volume of firebox and comb. chamber, cu. ft.	505

Fig. 14—Preliminary results of improved and standard front-end arrangements in New York Central Class J-3-A locomotive No. 5408

which maximum evaporation has been or can be reached. It is possible to increase the firing rate beyond this point, but the increasing heat losses due to unburned fuel and incomplete combustion offset the heat required to evaporate the additional water. This point is indicated on the graph by an arrow.

Fig. 13 shows graphically the test results with the use of the divergent nozzle as compared with the use of a straight side circular nozzle. The sketch superimposed on the graph shows the Class J-3 locomotive improved front-end arrangement and the divergent nozzle. The rate of evaporation has been maintained with an appreciable decrease in exhaust pressure.



The exploring tube being used by a test observer

Preliminary results of the J-3 locomotive tests are shown graphically in Fig. 14. The actual rate of evaporation is shown in relation to the rate of fuel fired. It will be noted that the maximum rate of evaporation, as defined above, has not been reached for the *JR* series with the improved smokebox arrangement and divergent nozzle. An appreciable increase in evaporation at the upper firing rates has been obtained with a decrease in exhaust pressure.

Conclusions

The design presented in Figs. 12 and 14 show a smokebox arrangement whereby the stack has been lengthened and the resistance to the flow of gases has not been increased. The table plate has been lowered 10 in. and the diaphragm has been cut away at the sides adjacent to the smokebox shell an amount equal to the area taken away by lowering the table plate. These cut-outs are not very large and, therefore, the remaining portion of the diaphragm will be sufficiently large in area to function as an impinging surface for the cinders instead of having them strike directly on the netting of the box-type spark arrester.

The cut-outs in the diaphragm also shorten the path of the gases coming from the flues above the bottom of the diaphragm by permitting the gases to pass directly to the stack with two right-angle turns, or 180 deg., instead of five right-angle turns, or 450 deg., as in the usual tortuous route of the conventional design. This particular design represents an increase in efficiency resulting from the improvement in the design of the smokebox arrangement by systematic experimentation with mathematical calculations and theoretical principles entering where they may be useful.

American Car and Foundry Develops New Design of

Covered Hopper Car

Car for loading of bulk commodities has maximum cubic capacity of 2,040 cu. ft. with light weight of 48,100 lb.

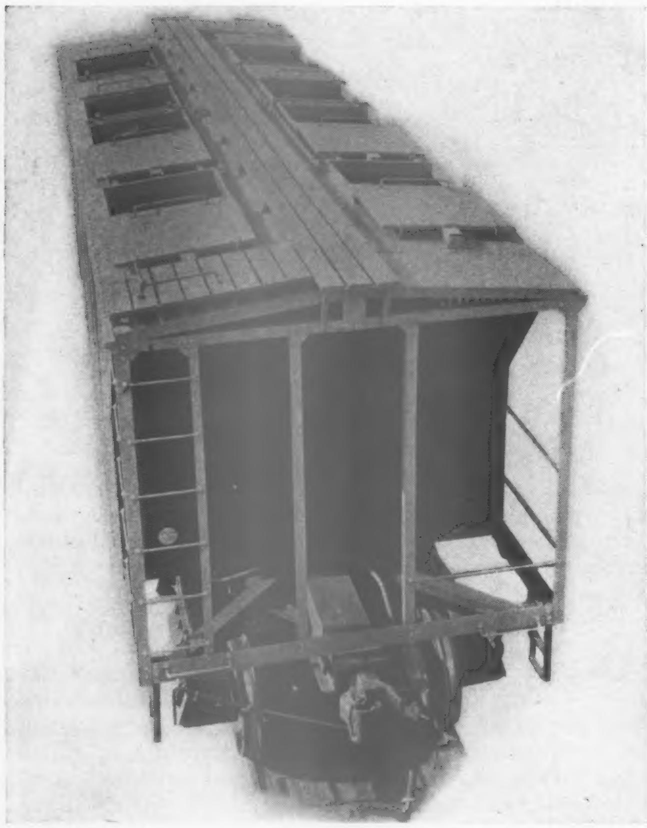
AFTER an extensive study of covered hopper-car designs with a view to producing a car having greater earning capacity than existing designs the American Car and Foundry Company has built a demonstration car acfx No. 50000 developed expressly for the handling of such bulk commodities as cement, clay, lime, powdered coal, dolomite, glass sand, etc. This new car has a light weight of 48,100 lb. and a nominal capacity of 140,000 lb. The body of the car weighs 29,640 lb. and the trucks 18,460 lb. By comparison with this car the A. A. R. standard design of 70-ton hopper car weighs 30,640 lb. for the body and 18,250 lb. for the trucks, or a total of 48,890 lb. The cubic capacity of this covered hopper car, when loaded to the junction of the roof sheet with the side plate, is 2,040 cu. ft. If loaded only to the top of the horizontal side plate web, the capacity is 1,981 cu. ft.

Cement, as it is blown into the car at the loading position, weighs about 80 lb. per cu. ft. because of the air trapped in it. During the loading operation, a portion of this air will escape as the cement settles and before the car has travelled very far a sufficient portion of this air will have escaped and the cement settled so that it has a density of from 92 to 96 lb. per cu. ft. This car has sufficient cubic capacity to permit loading to the full revenue load limit of 161,900 lb., or nearly 81 tons. As compared with the largest covered hopper car previously built by the American Car and Foundry Company for cement transportation, this car has an increased capacity of 82 cu. ft. when figured to the junction of the roof sheet and the side plate and 89 cu. ft. to the top of the horizontal web of the side plate. On the other hand, its light weight is 3,500 lb. less. The revenue load limit is thereby increased by a like amount or about 2.2 per cent. Compared with the previous car, the ratio of light weight to revenue load is changed from 3.07 to 3.36 and the percentage of revenue load to rail load limit from 75.5 to 77.1 per cent.

Structural Features

The center sill consists of A. A. R. rolled-steel Z-sections weighing 36.21 lb. per ft. with the top flanges welded along the center line of the car. The end sills consist of two 6-in. by 3½-in. angles extending from side sill to side sill and the side sills consist of two 6-in. by 3½-in. angles extending from end sill to end sill. The strikers are drop-forged and separate drop-forged draft lugs are welded to the center sill. The four diagonal braces are 5-in. by 3½-in. angles attached to the side and end sills and to the bolsters and center sills by means of gussets. The body bolsters are 24-in. by 9-in. car builder's sections extending from side sill to side sill across the top of the center sills to which they are welded and further connected by ⅜-in. gussets. The web of the bolster is riveted to the side stakes and the side sheet at the bolsters by means of 3½-in. by 3½-in. angle connections.

Demonstration covered hopper car built by the American Car and Foundry Company



End construction of the car and arrangement of the roof and hatches

The slope-sheet supports at the bolsters are $\frac{5}{16}$-in. bent plate extending the full width of the car and connected at the side of the car to the connection angles, previously mentioned, and near the center of the car by means of gussets to $4\frac{1}{8}$-in. Z-supports. The slope-sheet supports are connected to the bolsters by means of 5-in. by $3\frac{1}{2}$-in. angles which are separated by a 6-in. by 4-in. angle and extend longitudinally to connect the end floor-sheet stiffeners. The body side bearings are of hardened

Principal Weights and Dimensions of A. C. F. 70-Ton Covered Hopper Cars

Length over strikers, ft.-in.	35- 3
Length inside, ft.-in.	29- 3
Length, center to center of trucks, ft.-in.	25- 3
Width over side plates, ft.-in.	10- 5
Width inside, ft.-in.	10- 0
Height, over running boards, ft.-in.	12-10¼
Height to top of side plates, ft.-in.	11-10
Capacity (top of side plate horizontal web) cu. ft.	1,981
Capacity (junction of roof with side plate) cu. ft.	2,040
Light weight, lb.	48,100
Load limit, lb.	161,900
Ratio light weight to revenue load, per cent	3.36
Ratio revenue load to gross weight, per cent	77.1
Hopper centers, ft.-in.	11.9

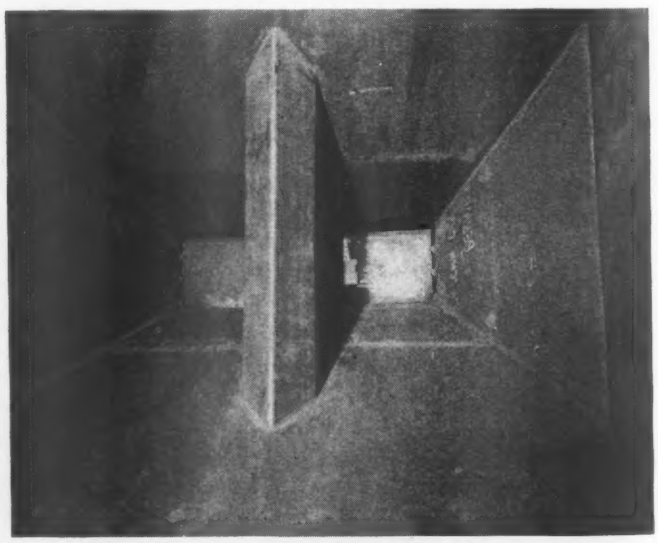
steel and the side-bearing members consist of an 8-in. I-beam welded to the bolster and the center sill flanges by means of angles. The body center plates are drop forged.

The slope sheets are $\frac{1}{4}$-in. plate extending from side to side and from carline angle to a point slightly below the sills where they are welded to the slope-sheet extension which continues to the discharge gates. The slope sheets are welded to the side sheets, outside hopper sheets, discharge gates, inside hopper sheets and longitudinal hoods.

The center partition is $\frac{1}{4}$-in. plate extending from side sheet to side sheet and from the underside of the roof at the center carline to a point approximately 15 in. below the joint of the cross-ridge floor slope sheets. The cross ridge slope sheets are $\frac{1}{4}$-in. plate extending from side to side. They are in two sections welded together at a point slightly below the center sill. The cross-ridge sheets are welded to the partition sheet at the top as well as to the side sheets, outside hopper sheets, inside hopper sheets, discharge gates and longitudinal hoods. The outside and inside hopper sheets for the four hoppers are of $\frac{1}{4}$-in. plate with welded connections to the side and slope sheets, longitudinal hoods and discharge gates. The longitudinal hoods are $\frac{1}{4}$-in. plate extending between the floor slope sheets over the center sills and are welded at the connections. The discharge gates are of the sliding type, manually operated. They move lengthwise of the car and are arranged to permit full or partial openings.

The side sheets on these cars are No. 7 gage open-hearth steel butt welded to each other and welded to the slope and hopper sheets, as previously described. The side plates are of 3-in. Z-bar extending the full length of the car with $1\frac{3}{4}$-in. by $1\frac{3}{4}$-in. sub side-plate angles. The intermediate side stakes are $\frac{1}{4}$-in. pressed plate with $\frac{3}{8}$-in. pressed stakes at the bolsters, extending from the side sills to the side plates. All of the side stakes are welded to the side sheets. The corner posts are $3\frac{1}{2}$-in. by $3\frac{1}{2}$-in. angles and the end posts are 3-in. by 3-in. angles.

The roof construction consists of 11 carlines of 3-in. by 3-in. angles formed to suit the contour of the roof sheets which are of No. 11 U. S. gage steel riveted to the carlines. There are eight hatches, four on each side,



Welded construction of the car provides smooth interior surfaces

of $\frac{3}{16}$-in. open-hearth steel with longitudinally sliding covers of No. 11 U. S. gage steel. The locking arrangement for the hatch covers is arranged so that one man standing on the running board of the car can lock or unlock all eight hatch doors by throwing one lever. After the doors are unlocked, it is necessary only to raise the front end of the door slightly so that a lip on the door will pass over the top of the hatch frame and the door may be slid back to the full open position.

Upon the completion of acfx No. 50000, the car was subjected to a series of impact tests by loading to practically full rail load limit with wet sand. The total weight on the rail was 209,800 lb. The test car was used as a striking car and the car which was struck was a heavy steel car loaded to full rail limit of 209,820 lb. Eight

impact tests were made at speeds of from 5½ to 12 m. p. h. The test results evidenced the ability of the car structure to withstand the stresses imposed.

Trucks and Brake Equipment

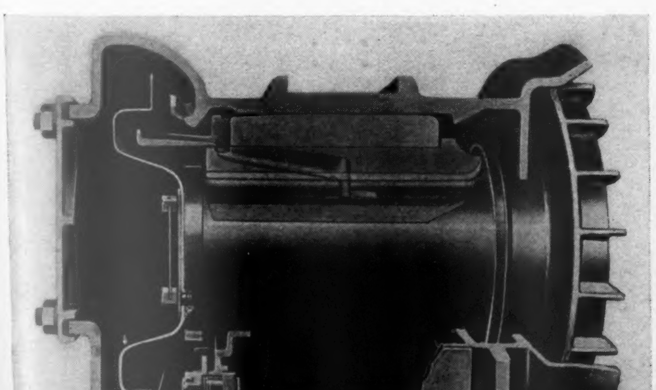
These cars are carried on four-wheel trucks with cast-steel double-truss type side frames having boxes cast integral. The bolsters are cast steel with integral center plates. The trucks are equipped with A. A. R. 33-in. diameter chilled wheels and 6-in. by 11-in. A. A. R. standard axles. The truck wheelbase is 5 in. by 8 in. The brake equipment is the latest AB schedule with 10-in. brake cylinders.

Dust-Deflecting Fans on National Journal Boxes

The National Malleable and Steel Castings Company, Cleveland, Ohio, has redesigned both its Isothermos and waste-packed journal boxes to include the application of a dust- and dirt-excluding fan in place of the standard dust guard. An additional feature has been incorporated with the fan in both applications. An oil-retaining ring is an integral part of the fan for the Isothermos box while included with the fan for the waste-packed box is a thrust ring that doubles the thrust area against the journal bearing over that in the present A. A. R. axle.

The Isothermos journal box is designed to meet modern railroad transportation requirements of heavier axle loads and higher speeds with reduced maintenance expense. They may be applied with A. A. R. standard axles to various types of trucks including the wide pedestal design generally used with roller-bearing boxes. When applied new, or when wheel renewals are made, the equipment may be operated immediately in high-speed service as special breaking-in is not required.

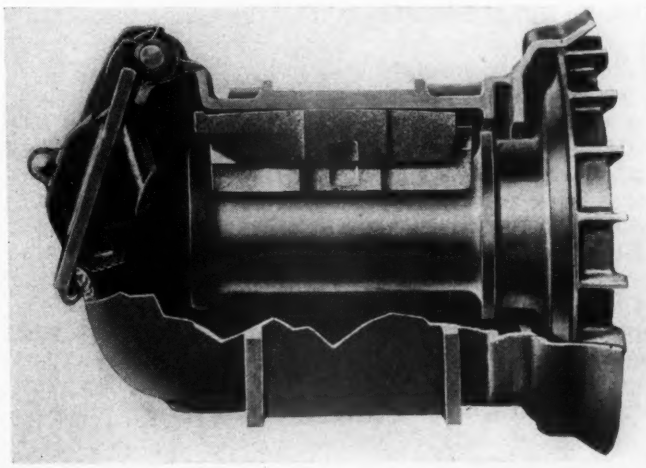
This journal box furnishes lubrication comparable to an oil bath, without the use of auxiliary parts that may be subject to wear. The box is properly lubricated by the use of an all-year grade of oil. It is not necessary to change oil or to add thinning oil en route to protect against temperature changes. Seasonal oils are recommended only when temperatures are lower than 40 deg. below zero or when the boxes are installed on extra heavy equipment. Depending on the size, the box has an oil capacity of from five to eight pints. This is about the same amount of oil as is required for saturization in a waste-packed box. The oil circulation is approximately one pint per mile.



The National Isothermos journal-box assembly produces lubrication comparable to an oil bath and uses an all-year grade of oil—The dust-deflecting fan and the oil-retaining ring are shown at the right

One illustration shows the Isothermos journal-box assembly applied with an A. A. R. standard axle. The dipper, attached to the end of the axle, carries the oil from the bottom of the box upward to the oil tray cast on the outer end of the wedge. At low speeds, the oil is dropped on the tray and at high speeds the oil is thrown to the top of the box from where it drains to the oil troughs cast in the box and then drops on the oil tray. From the oil tray, the oil passes through grooves in the bearings and is spread over the length of the journal. The grooves in the journal side of the bearing have a wedge-shaped space that retains a small amount of oil in contact with the journal when the equipment is standing. The oil remains in this space indefinitely and immediately lubricates the bearing when any movement of the equipment takes place. A baffle retaining block is applied at the front end under the journal after the bearing and wedge are in proper position. This block restricts the vertical movement of the box with respect to the journal and prevents displacement of the wedge or bearing when operation is over rough track.

The oil-retaining ring and dirt-excluding fan is shrunk on the axle between the journal fillet and the wheel seat. The oil-retaining ring is located adjacent to the journal



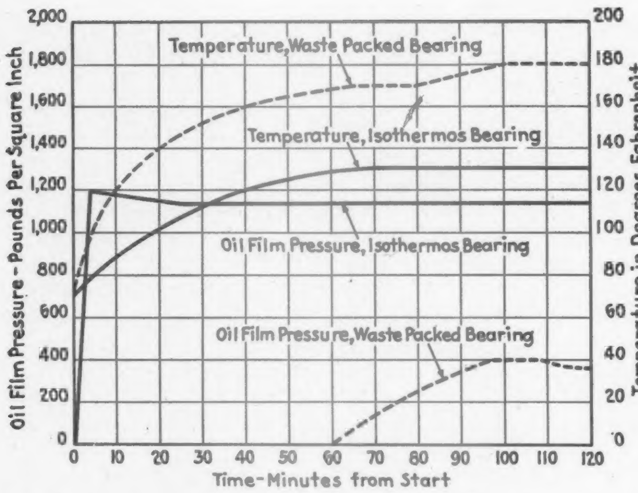
The National waste-packed journal box with the dust-deflecting fan shrunk on the axle—The thrust ring produces a 100 per cent increase in thrust area as compared with the present A.A.R. axle

fillet while the projecting fan blades extend over the wheel hub. The fan blades are shielded by a circular hood located at the back end of the journal box. As the fan revolves with the axle inside this housing, the blades create a violent air turbulence thus preventing the entrance of foreign matter into the box.

A special design of these boxes is available for service in freight cars that are handled over car-dumping machines. Cavities located in the sides of the box retain the oil while the box is on end during the dumping operation.

Among the outstanding records of Isothermos journal-box installations is that of two million locomotive tender miles under maximum wheel and tender loading without a hot box. These tenders operate in a climate where the temperate range varies from 100 deg. above to 35 deg. below zero and use only an all-year oil.

Six high-speed Diesel-electric locomotives equipped with these boxes have operated more than 3,441,900 locomotive miles. These locomotives have an average avail-



Typical oil film pressure and temperature curves for waste-packed and Isothermos journal bearings

ability of 95.5 per cent and one of them has had an availability of 99.3 per cent for 515,485 miles of service.

Under a freight car operating exclusively in service that requires the car to be unloaded on a car-dumping machine, journal boxes of the special car-dumping type have given six years of satisfactory service. The boxes were sealed and no lubrication attention was given them between annual inspections. This car operates more than 12,000 miles each year.

The data shown graphically in the chart were obtained from tests made on the National journal-box testing machine. The load on the 5½-in. by 10-in. journal was 20,000 lb. The speed was equivalent to 60 m. p. h. and the bearings were well broken in. Oil film pressures were measured at the center of the bearings by means of a high-pressure gage and temperatures were measured at the sides and near the rear of the bearings.

A comparison of the curves shows that the Isothermos box had a stable oil film pressure from the start of the test while the waste-packed box bearing operated 60 min. before the oil-film pressure started to build up. At no time during the 120 min. operation was the oil-film pressure in the waste-packed box sufficient to carry the load completely.

The dust-deflecting and thrust-ring fan applied to the National waste-packed journal box is shown in one of the illustrations. Except for the housing around the fan, all essential parts of the box conform to A. A. R. standards. As a protection against end wear and failures at the wedge stop lug, a 100 per cent increase in thrust area, over that in the present A. A. R. axle, is obtained by the thrust-ring part of the fan. The wheels can be turned without removing the fan from the axle and the box can be jacked for the removal of the wedge and bearing in the usual manner. For existing boxes, fan housings can be furnished separately for application by welding.

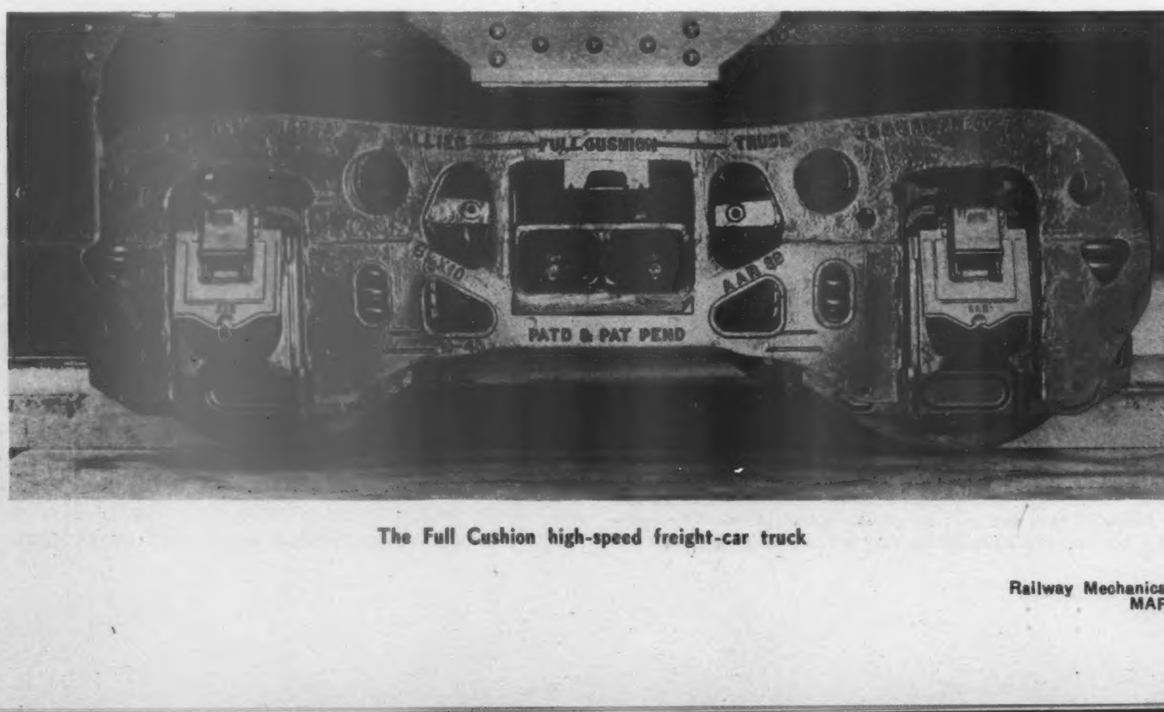
The National waste-packed journal box has the Flexo A. A. R. lid using a double coil spring of large diameter and moderate wire size. This spring produces sufficient pressure at the center of the lid to hold it tight against the face of the box regardless of the condition of the hinge lug. Serrations are cast on the inner face of the lid where it contacts the box. In service, these wear slightly into the box face or into high spots and help to make more efficient the oil- and dust-tight joint between the lid and box faces.

Full Cushion Truck

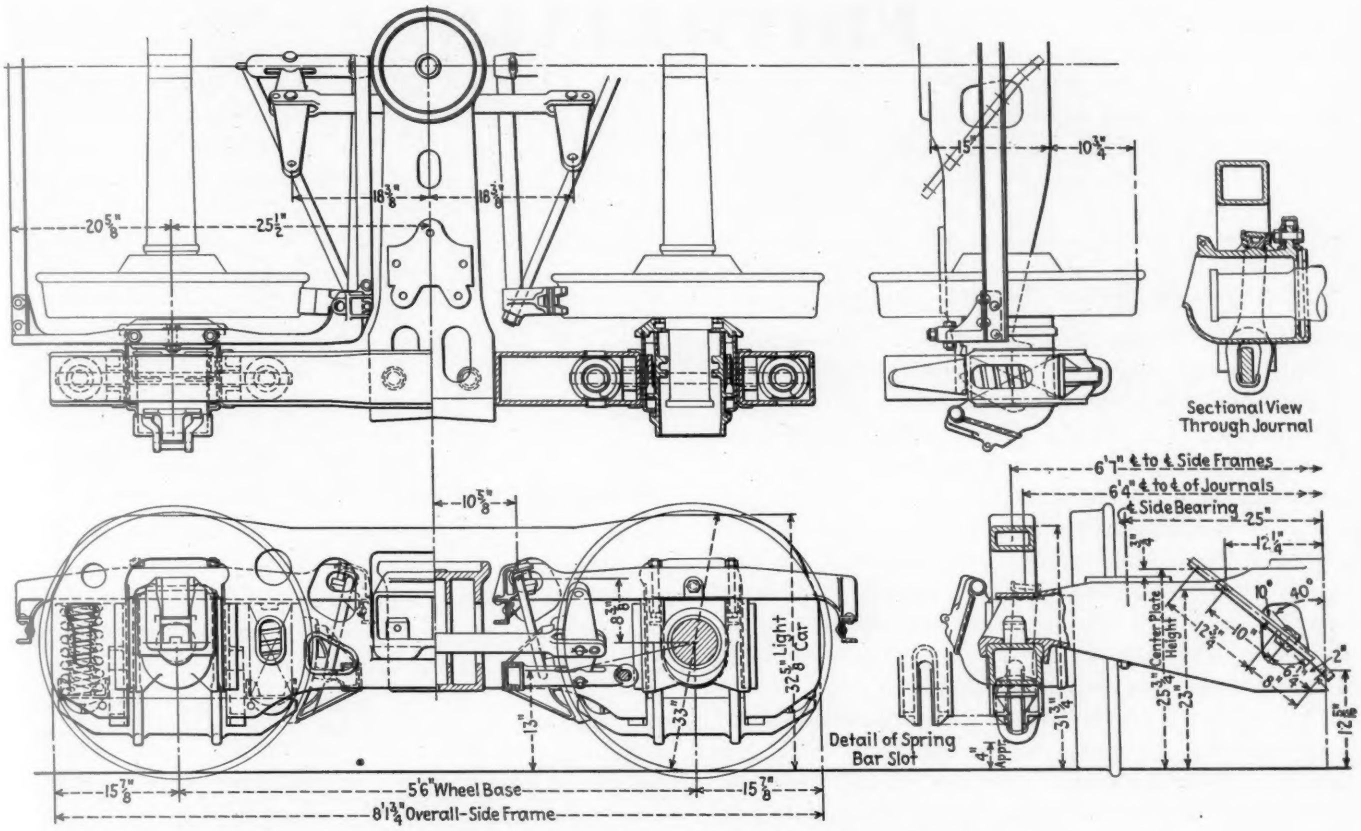
The Allied Railway Equipment Company, Chicago, is offering a new high-speed freight-car truck of novel design which has shown favorable results in both test and regular service. Known as the "Full Cushion" truck, it is a cast-steel development of the truck of that name included in the Association of American Railroad tests last year at Altoona, Pa. The side frames and bolsters are designed to comply fully with all A. A. R. specifications for material and for test requirements.

The truck provides long vertical spring deflection. It is also designed for lateral stability by limiting to the wheels and journal boxes all the lateral reactions from the wheels. This lateral control also eliminates the usual unsquaring forces of a rigid type of truck. Vertical and lateral shocks at all car speeds are said to be absorbed in the truck itself, therefore not being transmitted to the car body or its lading.

The Full-Cushion truck differs from other freight trucks in that, with the bolster resting directly on the side frames and automatically locked in position an H-shape rigid assembly serves as the main member of the truck. The separate journal boxes can move vertically



The Full Cushion high-speed freight-car truck



General arrangement of the Full Cushion freight-car truck

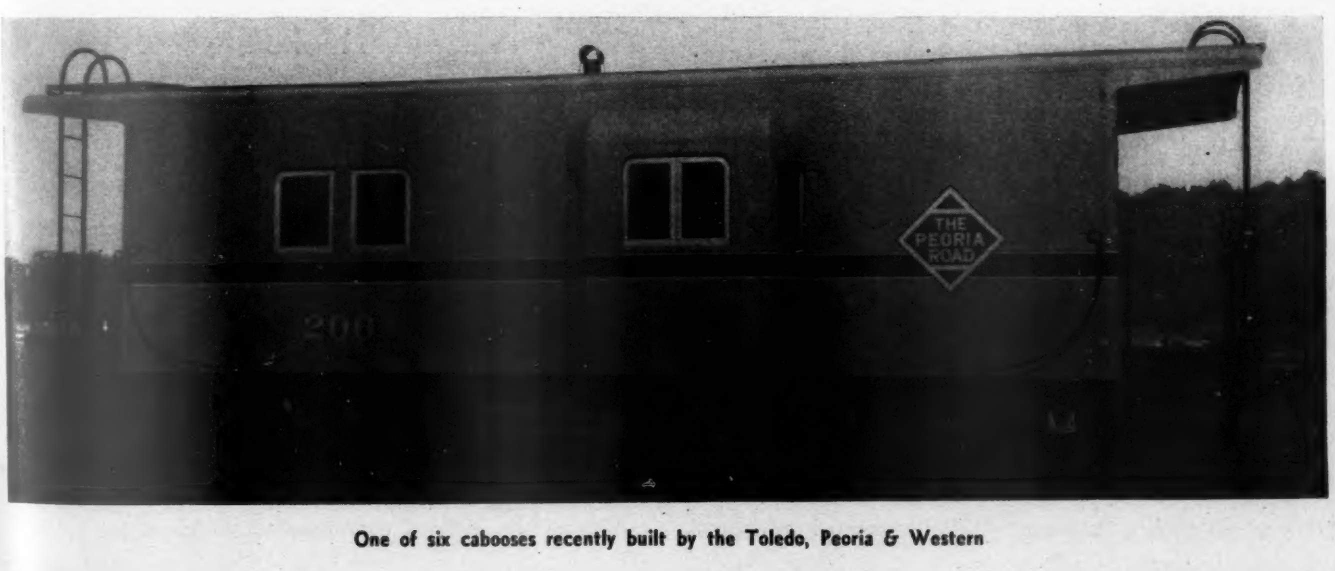
and also laterally in the pedestal openings of the side frames. The boxes for each pair of wheels are connected rigidly together by a rectangular frame that spans the wheels and, therefore, move laterally as a unit, the vertical movements being independent. This frame provides a support for the usual brake beam and connections and is suitable also for the use of clasp brakes when desired.

Springing is accomplished by the use of two long double-coil springs of large diameter, one at each side of each journal box, housed in space in the side frame adjacent to the pedestal guide. The springs when in position rest on seat castings which engage a spring-supporting bar extending across the pedestal openings below the journal box and between guides at the lower end of the pedestal jaw.

The spring load is transmitted to the journal box from the spring-support bar through an inverted U-shape hanger which straddles the box and projects below it. The enlarged ends of this hanger are designed with elongated holes or slots, through which the spring-support bar may be readily inserted. These journal-box hangers can swing laterally of the truck about the bearing point on top of the boxes, their neutral position being with the lower ends angled outward. Provision is made, by means of safety stops on the journal box contacting the side frame, for generous lateral motion of the wheels, axles and journal boxes independent of the truck bolster.

The assembly of the truck and the relative movement of the main framing and the wheel and box assemblies are shown in the drawing.

* * *



One of six cabooses recently built by the Toledo, Peoria & Western

EDITORIALS

Safety—A Real Asset

While the railroads can well afford to take pride in their accomplishments in reducing accidents to both their employees and to the passengers, the record is still far from satisfactory. With increasing traffic and the greater number of employees required, the accident rate is again creeping up.

Leaving humanitarian considerations aside for the moment, the economic effects of accidents are very great, when loss and damage to material and equipment and interruptions to service are considered. When, however, this is supplemented by the distressing effects upon the morale of the organization and the suffering of the worker and his dependents, it would seem that almost any effort would be warranted to reduce the number of accidents to a minimum.

A study of the awards made to railroads by the National Safety Council and of the E. H. Harriman Memorial Medal awards under the direction of the American Museum of Safety, indicates that some roads consistently maintain much better safety records than others. This does not just happen. There must be sound reason for it. Is it not primarily a matter of intensive education and of a positive policy on the part of the managements to secure and maintain the greatest possible safety? The entire organization must be made to feel "safety conscious." This does cost time and money, but it does insure results, tangible and otherwise, that many industrialists believe much more than offset such expenditures.

Sabotage

It is easy to grow hysterical as one understands some of the terrible things that are happening in world affairs today, and even within the boundaries of our own favored land. On the other hand, there is danger that these long continued recitals may cause us to grow careless and indifferent and that we may not be awake to sabotaging in our own communities. The most dangerous criminal or operator may not, and quite likely does not look the part. Too often his methods are so well veiled that we have difficulty in recognizing them, with the result that we find our morale being undermined and production slowed up—something far more dangerous and damaging than the breaking of a machine or the turning out of a spoiled piece of work or equipment. It is a time when we must not become jittery or do sloppy thinking. We must keep level heads on our shoulders and, without prejudice or bias, watch things closely to prevent serious damage being done, whether to materials or equipment, or in sapping our morale.

What Kind of Cars?

One of the interesting aspects of the national defense program is the change it is effecting in the relative volume of various commodities and in the acuteness of the demand for freight cars of various types in various territories. These changes are one of the difficulties in the way of every attempt to forecast the probable trend in the demand for freight cars during the current year.

This situation was touched upon by C. H. Buford, vice-president, operations and maintenance department of the A. A. R., speaking, early in January, before a luncheon in Chicago sponsored by the Mid-West Shippers Advisory Board and the Public Affairs Committee of the Traffic Club of Chicago. With all these uncertainties, however, he expects the emergency traffic to provide a continuous, all-year loading which "will fit in with the usual pattern of commercial traffic to provide a more complete year-around utilization of equipment.

Already there are evidences that such is the case, at least so far as certain types of equipment are concerned. Last year there were a number of recurring pinches in Michigan affecting automobile box cars with end doors and to a lesser extent box cars in the west. Prompt action on the part of the Car Service Division and the willingness of the railways to cooperate in carrying out its special orders have so far been effectively meeting these situations as they arise.

Trend in Number of Freight Cars of Principal Types* Ordered

	1939	1940	First six weeks 1941
Box	20,170	31,069	6,923
Auto-box	559	3,178	525
Gondolas	5,859	7,979	4,520
Gondolas, Mill type	350	415	625
Hopper	20,884	12,230	1,405
Hopper, covered	557	1,896	185
Ore	1,749	222	200
Ballast	534	1,954	250
Flat	977	932	572
Stock	100	338	300
Tank	2,277	1,623	....
Refrigerator	675	1,285	1,035

* A few types of cars for industrial use, ordered in small numbers, have been omitted.

One of the indirect evidences of the changing traffic

pattern is the sharp upward trend in orders for certain types of freight cars, most of them specialized for specific kinds of lading. In 1940, for instance, orders for automobile box cars and covered hopper cars increased in much greater proportion than did the total number of cars ordered. And during the first six weeks of the current year there have been similar striking proportionate increases in the orders for stock cars, mill type gondolas, refrigerator cars, all other gondolas, and flat cars. These relationships may be seen in the table of freight-car orders placed during 1939, 1940, and during the first six weeks of the current year. While the proportionate increase in these types is striking, the fact that they are usually ordered in relatively small numbers must be considered, and while the increase in the proportion of box-car orders is slight, the number is large—nearly 7,000 during the first six weeks of the year.

Now—And After . . . .

The machine tool industry of this country, during the years 1931-34 produced an average of 30 million dollars worth of new tools a year; in 1939 production was at the rate of 200 million dollars—greater than it was in 1929. In 1940 that production was more than doubled—450 million dollars—and in 1941 it is expected that the output will exceed 650 million dollars. These new tools have been and are now going into the industrial plants of the United States and other countries—mostly England—and are installed primarily to speed up work on defense contracts.

It has been suggested that when the war is ended and the nations of the world once again return to peacetime industrial efforts that the manufacturers of the United States may find themselves in a difficult situation as a result of intense competition in export trade aggravated by lower labor costs in other countries plus the fact that their plants are equipped with modern machinery built and sold by this country during the war period.

Many industrial executives in this country are farsighted enough to protect the interests of their own companies by using this period to put into effect a systematic program of replacement of the older and more obsolete units by machine tools of the most modern design with the definite idea that once the pressure of war-contract work has ended they can then carry out a program of wholesale retirement of the less efficient units and have remaining a modern plant and equipment, well able to compete, on a production cost basis, with whatever may come.

Age of Railroad Tools Averages Over 20 Years

What are the railroads doing to protect their interests with respect to the cost of repairing equipment and what situation are they liable to face when the time comes that reduced traffic will again cause them to give primary consideration to economy in operation? Attention has been drawn on many occasions during the past few years to the fact that railroad repair shops do not compare very favorably with other industries in the matter of modern shop facilities. In 1934 surveys disclosed that the average age of machine tools in the average railroad repair shop was over 20 years and it has been suggested that the railroad industry needed a carefully planned program of replacement of obsolete equipment in order to maintain an average age even of 20 years. Now, seven years later, it is not unreasonable to assume that, with the limited buying of the intervening period, the average age of tools is climbing to higher levels.

Recent surveys have indicated that 82 per cent of the machine-tool equipment of railroad repair shops is over 10 years old. Stated in other terms only 18 per cent of such equipment can be considered as modern equipment. A very large part of the machine tools that have been purchased in the past 10 years are of types especially adapted to railroad work such as driving- and car-wheel lathes, quartering machines, milling machines for special purposes such as driving boxes and shoes and wedges, vertical boring and turning machines with special tooling, turret lathes with tooling equipment for relatively small diameter bar and chucking work, grinding machines for specialized work, and welding equipment for both car and locomotive work.

New Tool Steels Have Taught a Lesson

Within the past five years a great deal of attention has been given in railroad shops to the use of the more recently developed tool steels in the high-speed and cemented-carbide class. The introduction of these newer cutting tools has been an enlightening venture in every shop where they have been used for they have shown possibilities for increased production and greater accuracy that were never before considered attainable. They have been used on most of the important machining operations involved in locomotive work—on brass, bronze, cast iron, gun iron and steel—and in addition to reducing operation time and providing finer finished surfaces they have demonstrated the ability of a tool to turn out quantities of work without tool regrinding that would have been considered an absolute impossibility only a few years ago. Still more important, these new tools have done something with respect to the older machine tools that should have been brought to light long ago; they have demonstrated the inability of the older machines to stand up to production schedules that are required today. The new tools have the ability to work at higher cutting speeds and heavier feeds but the older machines haven't the power, and in many cases the rigidity, to enable them to work at the increased capacity. The new tools have the ability to turn out work to standards of accuracy not heretofore attainable but most of the older machines are not in the physical condition to do this kind of work under the newer conditions. So, again the conclusion can be

drawn that most railroad shops are paying a rather heavy price for maintaining old machines in service.

Can Railroad Shops Work on Defense Orders?

Recently it was announced that the A. A. R. had made a survey of idle railroad shop facilities with the idea of using such facilities to supplement industrial plant production on national defense contracts. There is every reason why every idle production facility in this country be used in the re-armament effort but the suggestion to use the "excess" capacity of railroad shops raises some pertinent questions. When national defense contract orders are placed with a railroad shop are these jobs going to be assigned to the machines that are in the group representing the 18 per cent, or machines less than 10 years old or are they going to be put on the 82-per-cent group of 20-, 30- and 40-year-old machines? The 18-per-cent group will probably be found to be mostly specialized machines adapted only to special machining operations and it may also be found that there is now no idle capacity represented in this group of the more modern machines. The idle capacity will probably be found to exist on the oldest of the group of machines in any shop that are over 20 years old.

It is not, of course, possible at this moment to indicate just the type of defense contract work for which it is proposed to use this idle railroad shop capacity so that for purposes of discussion one example may be just as good as another. Let's use 75- or 90-mm. shell. An average railroad shop gets an order for the machining of shell forgings. On looking the shop over we find that of the major machine tools in the 10-year, or-over group, there are approximately 150 units varying in age from 12 to 41 years. Of these, 41 are engine lathes, 18 are turret lathes and 16 are boring mills. The rest are milling machines, drilling machines, planers or wheel or axle machinery. Among the turning and boring machines are the units that might be used for finishing shell forgings. Suppose, for example that the job is put on an engine lathe—the average railroad shop turret lathe is not of sufficient capacity to do this type of work—and an estimate is made of the time required to finish a shell of these types. The estimator will no doubt be shocked to discover that the production would be at the rate of *one* or *two* pieces an hour as compared with from *30* to *60* an hour on modern shell-turning automatics. At such a production rate, and cost, it is doubtful if the idle capacity of railroad shop machines can contribute a great deal to the defense effort unless an unforeseen demand for motive power should come under actual war-time conditions. Then, regardless of the cost, the productive capacity could be used—if the skilled workmen can be found to use it.

The conclusion to be drawn from a consideration of these facts is that the railroads owe it to themselves to find out immediately just what their situation is with respect to the adequacy of repair shop facilities. It is already too late to embark on any immediate extensive program of plant rehabilitation but it is not too late to know what is needed to put repair shops in a position to do their job economically. Now is the time to find out how much the obsolete machine is holding up production and running up costs and until this is found out no intelligent move can be made to improve conditions.

Possibly the government defense agencies might do the railroads a real favor by giving them a few educational orders so that they might discover how inadequate their present shop facilities are for modern production requirements.

Mechanical Conventions

Again our readers, widely scattered and members of the several mechanical associations, have come through with a page of comments on how to strengthen these associations and make their conventions more effective. Quite naturally these comments are not all in agreement, although the differences of opinion are not very decided. Certainly there is much that is really workable and worth while in the comments made in this and the two preceding issues. Judging from reports that have reached us, the officers of the associations and chairmen of the committees, are taking advantage of some of those ideas that apply with special force to their particular associations. We appreciate the cooperation that has been given us in conducting this forum and will be glad to continue it with your cooperation.

New Books

Proceedings Master Boiler Makers' Association, 1940 Annual Meeting. *A. F. Stiglmeier, secretary-treasurer, 29 Parkwood street, Albany, N. Y. 290 pages, 5½ in. by 9 in. Price $3.*

In the 1940 proceedings are Topics 1 to 8, inclusive—Use of Oxy-acetylene and Electric Processes; Causes for Pitting and Corrosion of Firebox Sheets and Rivet Heads; Treating Boiler Feedwater Chemically; Application of Iron, Steel and Alloy Rivets; Causes for Flues in Service Cracking Longitudinally Through Bead; Causes for Cinder Cutting of Firebox Sheets, Flues, Tubes and Smokeboxes, and A Study of Tender Cistern Maintenance Practices. There are also the addresses by Dr. Edward C. Elliott, on Some Neglected High Pressures; M. A. Quinn, on The Boiler Maker —His Accomplishments, Opportunities and Ambitions, and A. G. Trumbull, on Some Problems of Boiler Maintenance, Past and Present. There are papers on Welding Stresses, Use of Oxy-acetylene Cutting and Welding in the Boiler Shop, and Service Aging of Firebox Materials.

Suggestions for Mechanical Associations

As to Type of Reports

Discussions are longest on items that are most interesting. If a paper is read that is highly technical, or one that everyone feels he knows all there is to know about, which sometimes happens, there is very little or no discussion. These types of papers can and should be eliminated. With a two-day meeting we should also cut down on the number of speakers reading prepared speeches.

Eliminate Foolish Questions

When conventions are held without exhibits I am in favor of the curtailed meetings, and if handled right I believe two days is ample time for discussion purposes. If this plan can be worked out, and I can see no reason why it cannot, the committees should have their papers sent in far enough in advance so the secretary of the association can get copies out to all those indicating they will attend the convention. This would eliminate some of the foolish questions brought up in the discussions.

Conventions Too Formal?

Conventions of the minor mechanical associations are too formal. They are conducted much like a supreme court hearing. Less formality and more whole-hearted, common-sense, everyday discussion would materially improve the advantages gained by attendance. A two-day convention is a short time, even with proper planning. The contacts and friendships that can be followed up to advantage between conventions are not made on the floor of the convention, but instead, are made in those small informal groups that gather before and after the formal sessions. However, eliminating the general addresses, and devoting the time thus gained to a well participated in informal discussion on the floor, will to a great extent assist in promoting friendships.

Papers and Reports Too Wordy

Generally speaking, I believe the papers presented before conventions are too lengthy. Frequently the person compiling a paper is comparable to an author writing a book, and employs a great many words which to the average busy man are non-essential in a technical paper. In order for one to digest the essential points which are really worthwhile and mean something definite to the supervisor or foreman, one should not require him to read through or listen to unnecessary detail. In other words, while sitting in a convention listening to the average lengthy paper, possibly six to twelve notes on the part of the hearer would cover the essential parts of the entire address or paper. If a person is requested to write a paper and he has something of interest to impart to the convention, he should do so in the briefest manner. I feel quite sure that if all papers and discussions were streamlined, more could be accomplished during a two-day meeting than would be accomplished during a four-day meeting, following the old practice of long drawn out discussions and lengthy papers.

Don't Waste Time In Reading Reports

The most interesting comment to me is that in which the question is asked, "Why not devote all the time of the meetings to debate and discussion . . .?" In many cases in past years, we of the Fuel and Traveling Engineers' Association have done just that, particularly when time was short. I recall that as chairman of the Committee on Preparation of Coal, on more than one occasion I referred very briefly to the written report, inasmuch as advance copies were available to each member, and I saw no reason for the long-drawn formality of reading the full report. I heartily agree with you, that if an advance copy of each report is in the hands of each member in sufficient time for proper study, written discussion can be prepared in advance of the meetings, and the time required for presentation of each subject greatly reduced, leaving sufficient time for proper verbal discussion. The reading of the reports should be restricted to a brief outline of the subject.

Distribute Reports in Advance

It is true that much time is needlessly taken by the chairman of each committee reading the reports in their entirety. Touching only the high spots and presenting the report for discussion will suffice. Distributing the reports in advance is essential to a successful convention. It will also make for a more thorough and intelligent discussion.

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Comments from readers on suggestions made in our November, 1940, number for making more effective the efforts of the Mechanical Department Associations. See also January number, page 25.

Questions by Mail

I believe you have taken a step in the right direction with your suggestion that copies of reports be distributed in advance thus allowing more of the time of the meeting for open forum purposes. In my opinion you could also add to that the privilege to those unable to attend the annual meetings of submitting questions by mail for discussion on the floor, which could be answered either by the secretary direct, or incorporated in the proceedings.

More Effective Committee Service

Each committee member must actively participate in the meetings and investigations of his committee so the report will consist of cross country opinion rather than that gained by the experience of only one or two committee members. Obviously the shortening of the time of the meetings makes it imperative that each committee devote more time to the preparation of its report.

"Step On the Gas"

A statement was made in your editorial relative to the cutting down on the length of conventions presenting a real challenge to the associations. It is my belief that this challenge can be met if the officers of the various organizations do not wait until the last six weeks before the convention to handle matters they could have handled several months previous. There is no doubt in my mind that the conventions can be made as interesting in two days as they have been in four. We must all admit that the conferences last year had a tendency to drag out, and when this happens a certain amount of the attendance is sure to be lost.

What a Railway Officer Wants From Conventions

When a railway official attends a convention it is with the expectation of bringing home new ideas. He is always on the lookout for some simpler, or cheaper method of handling the various maintenance or construction jobs which he has to take care of in his shop, or shops. Furthermore, he is always on the lookout for new machine tools of advanced design, which will cut labor costs and increase output. He is constantly looking for new hand tools, either electrically or pneumatically operated, which will enable an employee to increase his daily output with less fatigue. He is constantly on the alert for safer methods of performing work in order to avoid accidents to employees, with the resultant burden of compensation.

Rivet Cutting with The Hand Blowpipe*

Today, oxy-acetylene cutting blowpipes equipped with nozzles especially designed for rivet-cutting have made the removal of rivets a simple matter in salvaging steel plate. Procedures also are now widely standardized, making the rivet-cutting process extremely fast and economical. This is in direct contrast to former methods, by which the removal of rivets was slow and tedious, often resulting in damage to the plate and leading to considerable waste or reduction of the amount of metal salvaged for re-use.

Rivet-Cutting Principles

Although rivets can be removed readily with the standard cutting nozzle, the fastest and most economical method is to use a special low-velocity rivet-cutting nozzle. This type nozzle differs in appearance from the standard nozzle mainly in that the central cutting-oxygen orifice is larger.

In practice, the preheat flames are directed against the center of the rivet head, bringing the metal quickly to its kindling temperature. The cutting-oxygen valve of the blow-pipe is then opened, releasing a stream of low-velocity oxygen through the central orifice of the nozzle. This jet of oxygen rapidly oxidizes the heated rivet head so that the metal "washes" away in the form of hot slag. The adjacent plate is not affected because of the presence of a layer of scale between the rivet head and the plate. The low-velocity stream of oxygen will not penetrate this scale without considerable preheat and the rivet head is removed long before the scale becomes sufficiently heated.

The special nozzle is 50 per cent faster than the standard nozzle in cutting buttonhead rivets, and it is the only satisfactory nozzle for cutting countersunk rivets. The low-velocity rivet-cutting nozzle operates effectively at a cutting-oxygen pressure of from 20 to 25 lb. per sq. in. for any type of rivet up to 1 in. in diameter. Larger rivets may require slightly higher oxygen pressures depending upon their size.

Cutting Countersunk and Buttonhead Rivets

To remove a countersunk rivet from a vertical sheet, stand to one side of the rivet and hold the blowpipe so as to direct the preheating flames at the center of the rivet head. The rivet-cutting nozzle should be at right angles to the surface of the plate and in line with the shank of the rivet as shown in Fig. 1. Hold the blowpipe steady until the area directly below the preheating flame becomes a bright red. Then open the cutting-oxygen valve and, as the metal oxidizes under the cutting jet, swing the blowpipe with a slow circular motion, at first over an area of about ¼ in. in diameter. When the coned head has been burned through to the body or shank of the rivet, remove the remainder of the head with one circular "wiping" motion, working outward from the center. The blowpipe should be held with the nozzle pointing at the base of the countersink throughout the operation.

The procedure for cutting buttonhead rivets with the low-velocity nozzle, Fig. 1, is similar to that for countersunk rivets. Start at the center of the head with the nozzle pointed along the center line of the rivet, preheat, and burn the rivet head until the shank or body of the rivet is reached. Then remove the balance of the head with a single circumferential "wiping" movement. Point the cutting-oxygen jet at the outside edge of the rivet

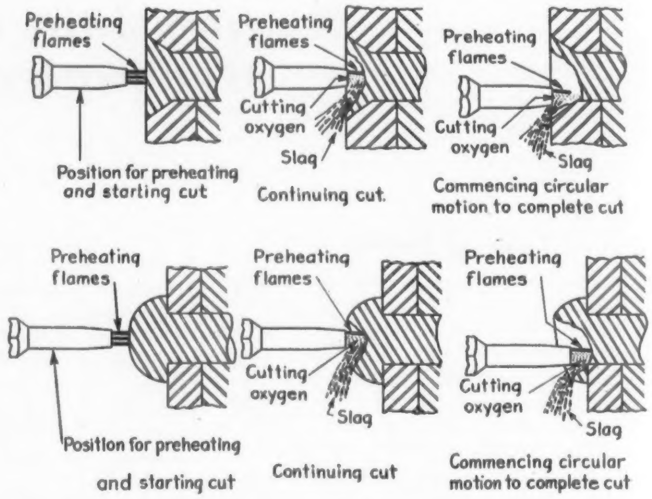


Fig. 1—Correct procedures for cutting countersunk (top) and button head (bottom) rivets with the low-velocity nozzle

hole in the outside sheet and follow the circumference around. The ring of metal (outside edge of the rivet head) which is left will fall away by itself.

Rivet-Cutting with Standard Nozzle

Where the low-velocity nozzle is not available, button-head rivets can be cut off by using a standard cutting nozzle as shown in Fig. 2. Use the size nozzle and oxygen pressure recommended by the manufacturer of the blowpipe for cutting steel 1 in. thick. Hold the nozzle parallel with the surface of the sheet, preheat, and cut a slot in the rivet head from the top of the button to the underside of the head, similar to the screw-driver slot in a round-head screw. In the cutting of the slot, the entire head will be preheated to a cutting temperature. As the cut nears the plate, draw the nozzle back at least 1½ in. from the rivet. Then, just as the slot reaches the plate, swing the nozzle through a small arc, slicing off half of the rivet head. Then immediately swing the nozzle in the opposite direction to take off the other half of the rivet head.

The nozzle must be drawn back from the rivet a distance of 1½ in. or even more while the bottom of the slot is being reached and just before cutting starts at the surface of the plate. This action permits the oxygen to scatter slightly before it strikes the rivet, and prevents

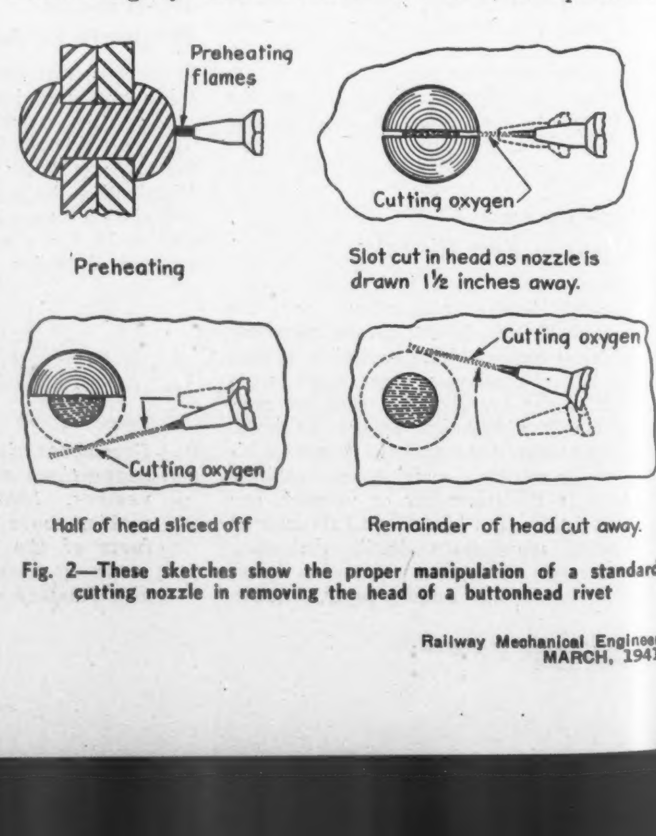


Fig. 2—These sketches show the proper manipulation of a standard cutting nozzle in removing the head of a buttonhead rivet

* Reprinted from the January, 1941, issue of Oxy-Acetylene Tips.

the jet from breaking through the layer of scale that is always present between the rivet head and the plate. As a result, the button drops off flush without damaging the base metal. If the nozzle is not drawn away, the force of the oxygen jet may pierce the film of scale and damage the plate.

Removing the Rivets

The low-velocity nozzle is specifically made so that it can be used to penetrate a rivet shank two or three plate thicknesses, or to pierce the entire shank, as desired by the operator. However, in normal practices, most operators prefer simply to remove the rivet heads as previously described and then back out the rivets with a hammer and punch.

Lafayette Air-Brake Repair Shop

The new air-brake room of the Chicago, Indianapolis & Louisville (Monon), located in the east end of the locomotive erecting shop at Lafayette, Ind., covers a floor space of 24 ft. by 58 ft. and was designed to consolidate all air-brake repairs at one central point, including other work of a similar nature formerly performed in other parts of the shop under handicap. It consists of six sub-departments, as follows: (1) Injector and lubricator repairs; (2) air-compressor repairs; (3) repairs to air-brake equipment, other than compressors, bell ringers, fire-door cylinders, pop valves, steam gages, etc.; (4) triple-valve repairs; (5) air-, steam- and signal-hose assembly, and (6) cab fittings, angle and cut-out cocks, and globe valves.

Each department is equipped with a work bench, necessary wrenches, reamers, and other small tools peculiar to its particular work. The tools are arranged on racks in such a manner that they may be quickly secured. Each department also is equipped with a rack on which a fixed stock of common repair parts is maintained. This material conveniently at hand expedites the repairs and reduces to a minimum the delay caused waiting for material. This fixed stock is checked by the stores department at regular intervals and the supply replenished as required. Acid and lye-cleaning vats are available to all departments.

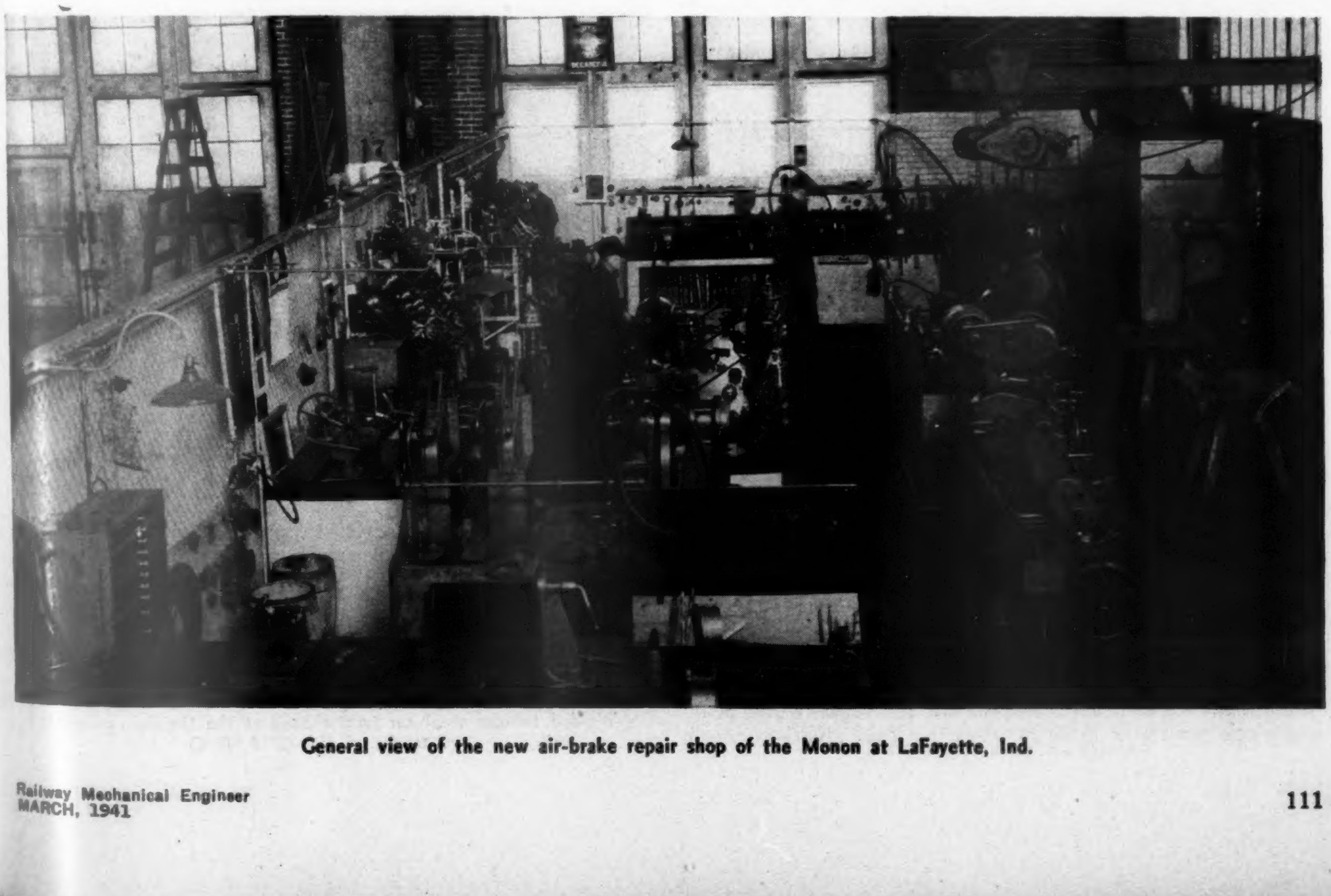
All machines are located to afford accessibility for any and all departments. The location of the air room permits the efficient handling of a compressor from the air room to the locomotive or vice versa. Likewise, by use of wire baskets, equipment removed from locomotive is carried by a crane direct to the air room for repairs.

Department No. 1 has a lubricator testing rack on which mechanical lubricators are tested under the same conditions which prevail on the locomotives in service. Gages and graduated glasses permit the operator to determine accurately the condition of the pumping units of the lubricators.

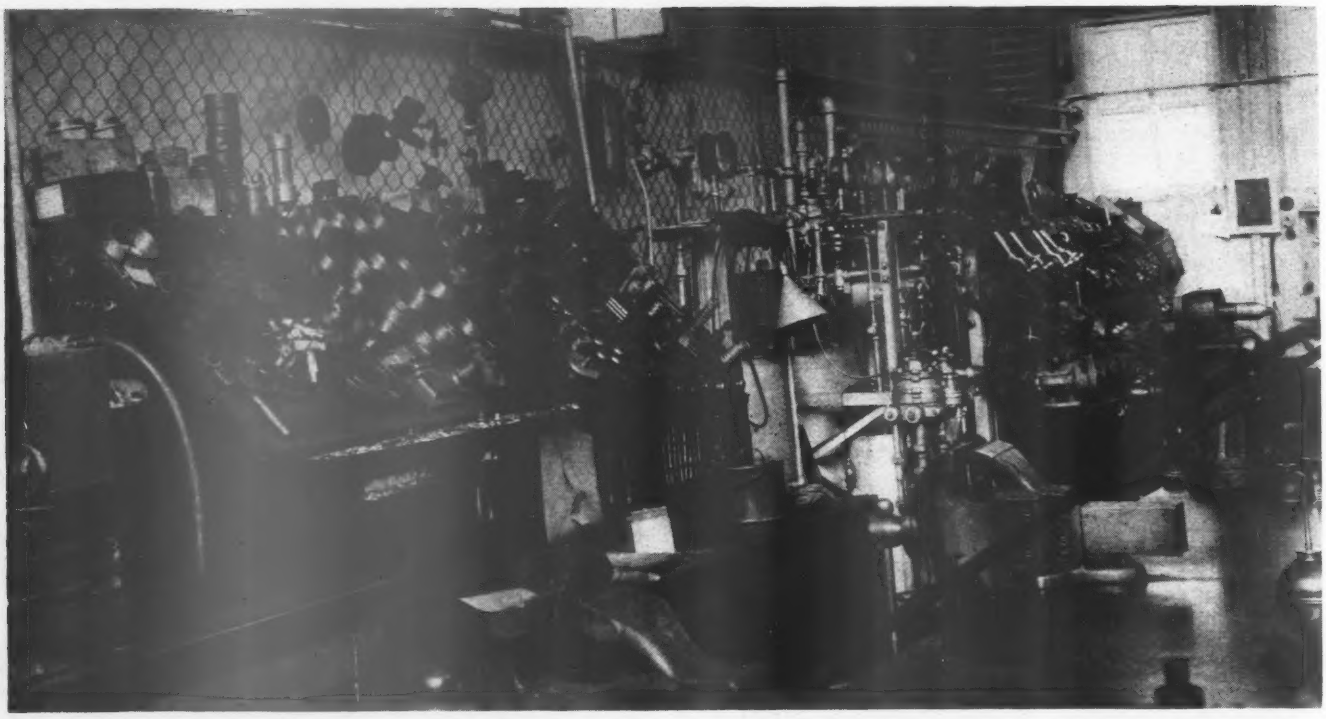
Department No. 2 has additional facilities of two racks on which locomotive air compressors are placed while undergoing repairs. It also has an 18-in. Lehman engine lathe, 8-in. pedestal-type emery wheel, and a one-ton electric hoist mounted on a jib crane over the racks, permitting handling of compressors without the use of the traveling crane. Accurate records are maintained by this department on cost of repair parts, labor to repair and service life of all compressors.

Department No. 3 is equipped with a test rack for testing individual parts of the air-brake equipment, also a 9-in. by 4-ft. South Bend bench lathe with 5-in. universal chuck to permit precision work and rapid handling of small parts requiring lathe work. For the grinding of valves and seats of the many different valves handled by this department, a semi-automatic valve-grinding machine is available, on which many valves may be semi-finished at the same time, eliminating tedious hand grinding individually. This valve grinder also is available to Department No. 4 as well as the necessary testing racks for this department.

Department No. 5 consists of the racks and air-



General view of the new air-brake repair shop of the Monon at LaFayette, Ind.



How standard repair parts and tools are kept readily available

operated machines necessary for the mounting of the various hose.

Department No. 6 consists of a grinding machine for angle cocks and other cone-seated valves, as well as necessary testing apparatus.

Material for shipment to other points on the line is easily removed by the stores department without inconvenience to other departments in the shop. The air room has sufficient natural light, but floodlights and individual bench lights afford good lighting under all conditions.

An important feature not previously mentioned is the design of benches and material racks so that all material and tools must be in sight. Also, thought was given to the layout in order to prevent so far as possible the accumulation of any parts or material on the floor of the shop. This feature of the shop automatically adds to the neatness and efficiency, and supervision accomplishes the balance that is not automatically cared for.

A Light, Strong Car Trestle

The illustration shows a light but strong car trestle, made of welded tubular steel and used successfully at the Chicago, Burlington & Quincy car-repair tracks, Omaha, Neb. The trestle is 42 in. high and the three supporting legs are spaced 22 in. apart at the bottom. The two legs *A* and *B*, are made of a single piece of 2-in. pipe bent at the middle (which is the top of the trestle) and forming a pocket to receive the upper end of leg *C*, which is welded in place. All three legs are tied together at the bottom about 12 in. above the ground level by ⅝-in. tie rods securely welded to the respective legs, as shown.

A flanged steel plate 4½ in. wide by 7½ in. long is welded to the top of legs *A* and *B* and also has a small welded reinforcing plate connection to leg *C*. This bracket serves as a firm support for the taper wood bearing-block which is held in place by two rivets through the bracket flanges. To give increased bearing surface on the ground, each leg of this trestle is equipped with a 6-in. by 8-in. steel base plate, welded securely to the end of the leg, which has been beveled to the proper angle. The base plates on legs *A* and *B* are turned up slightly on one edge so that a car man, by taking hold of handle *H* near the top of the trestle with one hand can easily pull the trestle from one place to another about the repair yard. In spite of its light construction, this car trestle is unusually strong, each trestle being tested with a load of 40,000 lb. before being placed in actual service.

Welded tubular steel car trestle used at the Omaha car-repair tracks of the C. B. & Q.

Crank-Arm Positioning Gage

To the small-shop valve setter new main crank pins mean additional labor because they are usually installed before the bolt slot and keyway are machined. This is often done by the valve setter after he has located the crank arm in its proper position.

The location of the eccentric crank arm is important as any slight deviation from its predetermined location may mean a radical distortion in the valve events. Many different gages and trams are used for this purpose. The accompanying illustration shows one that is both simple to make and easy to use. This gage is readily adjustable to different lengths from the eccentric-pin center to the main axle center; also from the driving-wheel face to the back of the crank arm.

The circle of the gage that fits tight against the axle face is made of brass or steel 3/8 in. thick and 7 in. diameter. The inside diameter is 4 7/8 in. The bar is made from 3/8-in. by 1 1/2-in. soft steel 16 1/2 in. long. This bar has a 3/8-in. slot 7 in. long milled in it near the end and the bar is secured to the circle with 1/4-in. cap screws. In the center of the circle, the bar is drilled and tapped with 1/2-in. U.S.S. threads and through this hole is screwed the adjustable center. This center can be raised or lowered so that it will fit snug in the center hole of the axle when the circle is tight against the axle face. It is locked in position with a wing nut. The rod that slides in the slot is threaded for 1/2 in. on the back, then filed flat on two sides to fit into the 3/8-in. slot. The thin nut that fits on the end of this rod is 5/16 in. thick and the body of the rod is turned to fit the inside of a piece of 1/2-in. brass pipe about 8 1/2 in. long with a point screwed in the outside end.

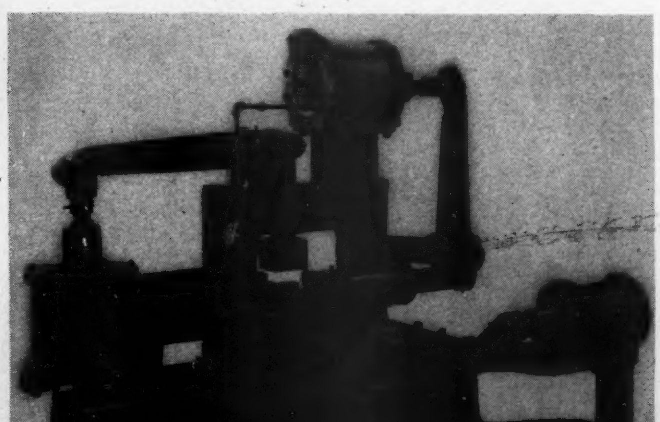
The ring of the gage is centered against the axle end and the position of the eccentric crank arm is located by the pointer

The gage is set to the required blue-print distance from the axle center to the crank arm pin center. The crank arm is placed on the pin in its approximate position and the gage held against the axle face with the center of the gage tight in the axle center. Both the gage and the crank arm are moved until the point of the gage coincides with the center of the eccentric-crank-arm pin. The crank arm is now in its correct position and the keyway and bolt slot are laid out for machining. Irrespective of other adjustments that may be necessary to square valves, the crank-arm setting is fixed.

Spring Assembling and Banding Machine

The spring assembling and banding machine, shown in the illustration is in use in the blacksmith shops of the Chicago, Indianapolis & Louisville (Monon), at LaFayette, Ind. It was constructed at an approximate cost of $850 and is used for the assembling of plates and tightening of bands on locomotive driving, trailing-, engine- and tender-truck springs.

The banding machine proper consists of a cast-steel frame upon which are mounted two 16-in. by 12-in. brake cylinders, necessary fulcrum arms and plungers, all of which are placed in such position that pressure may be exerted both horizontally and vertically on spring bands during the process of tightening them around the assembled plates. This frame is bolted to an iron bed plate mounted on a concrete base suitable in height to bring the table of the banding machine 26 in. above the floor level. The assembling machine consists of a 10-in. by 12-in. brake cylinder, operating plunger and stationary head mounted on a base level with the base of the banding machine. These two machines are connected by 3/8-in. boiler plate so that springs may be transferred from the assembling machine to the banding machine without the use of crane or hoist. Both the operating plunger and stationary heads of the assembling machine have notched faces to grip and hold spring plates and are mounted on ball bearings in order that springs may be revolved to either a vertical or horizontal position dur-



Spring assembling and banding machine built and in use at the LaFayette shops of the Monon

ing the process of assembling, preparatory to being placed in the banding machine. The various brake cylinders are independently actuated by compressed air, controlled by three-way valves.

The cast-steel frame of the banding machine is 4½ in. thick, overall dimensions 35 in. by 41 in., inside dimension 15¾ in. by 19¾ in. Fulcrum arms are cast steel, have a ratio of six to one, and are tapered from 7 in. by 9 in. at the fulcrum to 2½ in. by 5 in. at the long ends and 7 in. by 8 in. at the short ends. The long ends of these levers are slotted 2½ in. by 5¼ in. and connected to the brake cylinder piston by roller bushing so that the piston will not be out of alinement at the various angles of fulcrum levers. The bed plate of the banding machine is 2½ in. by 15 in. by 73 in., and is fastened to a cast-steel frame by ¾-in. by 5-in. by 6-in. by 41-in. angles. These angles are secured by bolts and are electrically welded around the edges. The plunger heads are finished to allow for the largest spring bands and necessary spacer blocks are used for smaller bands.

The clearance between the plunger head and the stationary head on the assembly machine is made ample to receive the largest spring used. The tightening of loose spring bands is brought about by placing the spring in the position shown in the photograph. Pressure is exerted against the band horizontally and the top side of the band is heated with oxy-acetylene flame in order to upset the band. When the band has been upset sufficiently, pressure is applied by the vertical plunger to force the band firmly against the edges of the spring plates. The spring is then turned over and the opposite side of the band is subjected to the same process after which the spring is placed in a No-oxide bath.

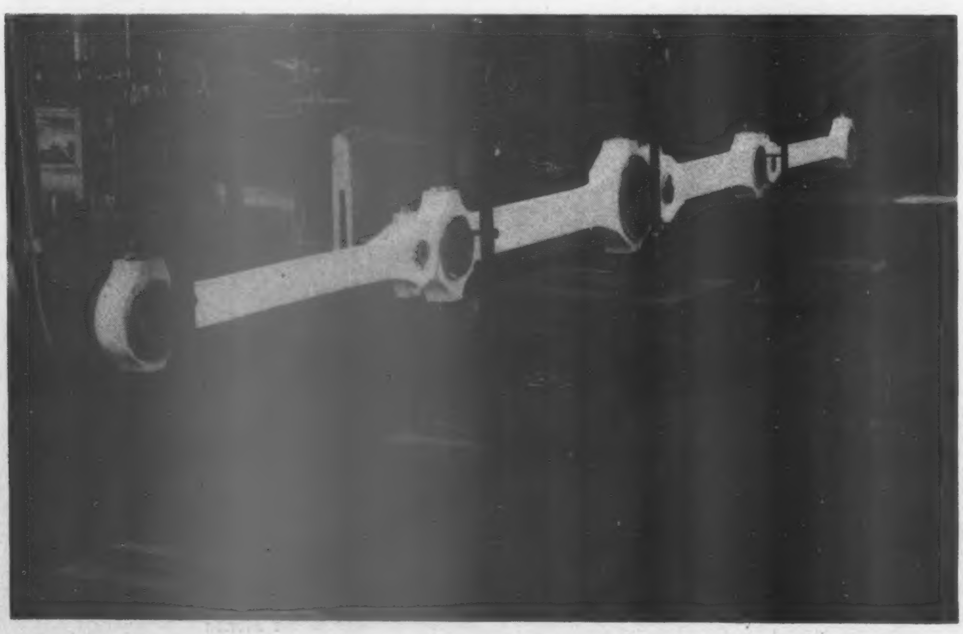
This machine was placed in service on June 17, 1940, and savings over former methods are said to have paid for it in five months.

Counterbalancing Driving Wheels

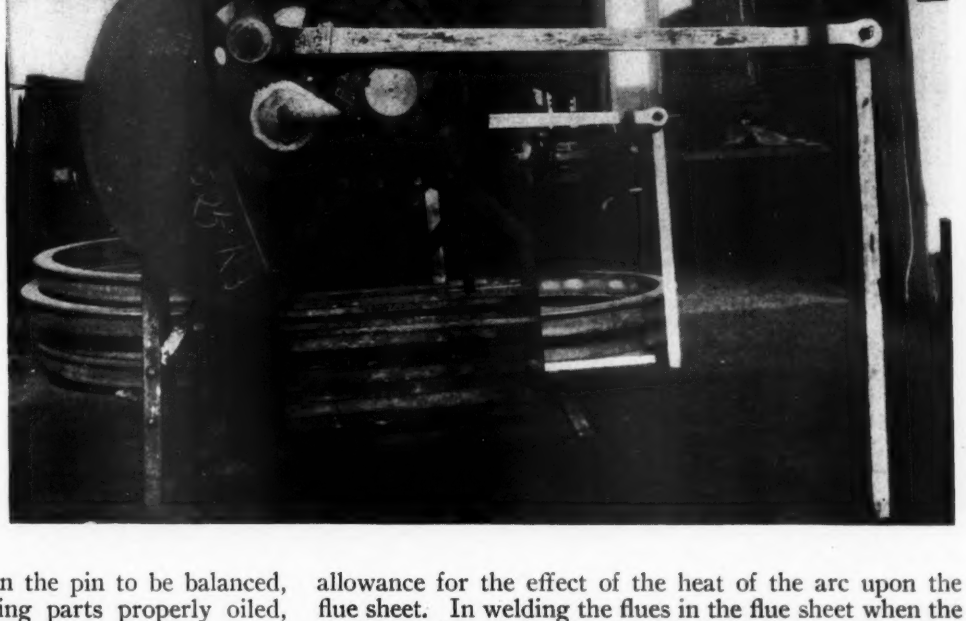
In order to obtain the actual weights of revolving and reciprocating parts on locomotives for the purpose of counterbalancing, the rod supports or stands shown in one of the illustrations, are used at the Chicago, Indianapolis and Louisville shop, Lafayette, Ind. These stands consist of ½-in. by 3-in. steel bars, bent to the shape indicated and bolted to 2½-in. by 12-in. by 15-in. oak base blocks. The vertical legs, 36 in. high are drilled with staggered ¾-in. holes spaced 3 in. apart. The side rods are assembled completely in order that all parts may be accurately weighed. They are then hung on the stands, leveled as shown, and supported practically on knife edges which consist of ¾-in. bolts running through the holes at the desired location on the stand. Pieces of pipe are placed loosely over these bolts in order to eliminate any tendency for the rods to bind at the point of support. The knuckle joints are lubricated and permitted to work freely in order to show the proper weight at each pin. The scale is then placed under each stand, as indicated, in order to obtain the weight at that particular pin hole.

After these weights have been obtained, the rods are dismantled and all placed on the scale in order to obtain the total weight. The sum of the weights previously obtained at the pin holes must equal the total weight of the rods so weighed. The front and back ends of the main rods are similarly weighed in order to obtain the distribution of weight at each end. All reciprocating parts, such as piston, crosshead, cylinder packing, crosshead key, union link, and necessary pins, nuts and washers are likewise weighed on the scale. The weights so obtained are recorded on a form and forwarded to the mechanical engineer's office where the theoretical weights to be counterbalanced at the pin at each location are calculated in accordance with the latest recommended practice.

After these weights have been determined, the driving wheels are then placed on the balancing stand, as shown in the second illustration. The top of the balancing stand consists of two parallel steel strips, machined accurately 3½ in. by 3½ in. by 36 in. in length. The driving journals rest on these parallel strips, which are leveled accurately, both before and after the driving wheels are placed in position, in order to permit wheels to roll easily. A yoke containing a roller bearing is then hung over the pin to be balanced. In the yoke is placed the theoretical weight desired to be balanced on that pin. This weight consists of brass plate castings, which are of various dimensions and convenient size and weight, with weights stencilled on them. The weight of the yoke itself is also known.



Supporting stands and platform scale used in determining rod weights on individual crank pins at the Monon locomotive shop, Lafayette, Ind.



Parallel-bar stand and equipment used in counter-balancing locomotive driving wheels—In the case of main drivers, both the eccentric and rods are applied

After this weight is placed on the pin to be balanced, and all rollers and other moving parts properly oiled, the eccentric crank and eccentric rod are assembled on the main pins in proper operating position, as illustrated, and a double plumb line is then thrown over the opposite pin. A circle is accurately scribed from the center of the axle equal to the diameter of the pin. With the theoretical weight, plus the actual other weights to be counterbalanced, hanging on the pin, the counterbalance on the side of the pin in question is now increased or decreased by proper mechanical methods until the plumb lines coincide with the scribed diameter of the opposite pin on the axle.

Of course, the eccentric crank and rod are not used on other than main wheels. It is good practice to try both sides of a pair of wheels before making any actual change in counterbalance weight, because any change on one side will affect the weight of the other. After changes in counterbalances are made, the wheels are re-checked until the desired accuracy is obtained.

Locomotive Boiler Questions and Answers

By George M. Davies

(This department is for the help of those who desire assistance on locomotive boiler problems. Inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless special permission is given to do so. Our readers in the boiler shop are invited to submit their problems for solution.)

Welding Flues with Empty and Filled Boiler

Q.—When welding flues to the firebox tube sheet of a locomotive boiler, is it preferable to have water in the boiler at the time of welding?—K. I. M.

A.—The advantage of welding the flues in the firebox tube sheet with water in the boiler is that the heat is dissipated more rapidly than when the boiler is dry. This allows the welder to proceed without making any allowance for the effect of the heat of the arc upon the flue sheet. In welding the flues in the flue sheet when the boiler is dry, the welder must first weld one row of flues, then skip a row and weld the next row. With a dry boiler, one-half the circumference of the flue is welded at a time, the second half being welded after the first weld has cooled so the heat of the arc will not set up stresses in the flue sheet and cause it to warp.

Either method of welding the flues is satisfactory; the matter of preference depends on conditions in the shop in which the work is being done.

Application of Larger Boiler Check Valve

Q.—We have several Mikado-type locomotives operating at 200 lb. per sq. in. boiler pressure on which we desire to increase the size of the boiler check valves from 2 in. to 2½ in. The check valves now on the engine have a 3¼-in. hole in the shell and are secured with six ⅞-in. studs on a 5¾-in. stud circle. There is a 9-in. by 9-in. by ⅝-in. square liner on the inside of the shell secured with four ¾-in. rivets, while the new check valve requires a beveled seat and is secured with six ⅞-in. rivets on a 6⅙₆-in. circle.

Due to the fact that the stud circle in the boiler is not suitable for the new check valve, will it be necessary to relocate the boiler checks and plug up the old holes in order to make this application?—M. E. D.

A.—Fig. 1 illustrates the boiler-check hole and liner as outlined in the question. It would be possible to apply the 2½-in. boiler check in the same location as the present boiler check by applying an outside liner to the boiler in the manner as illustrated in Fig. 2. It will be noted, however, that to do this, the flanges on the 2½-in. check

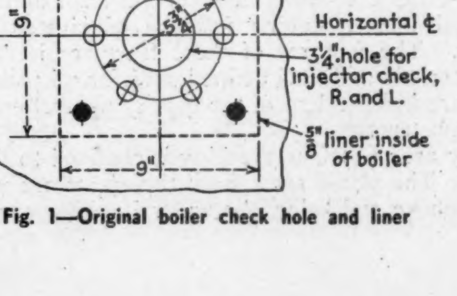


Fig. 1—Original boiler check hole and liner

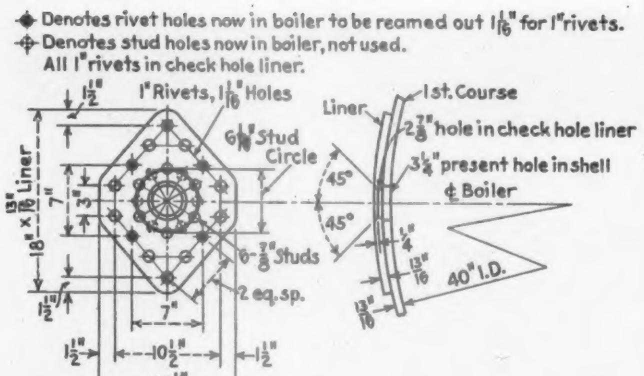


Fig. 2—Application of outside liner permits the use of a larger check valve in the same location as shown in Fig. 1

will have to come drilled so that the studs will fall directly between the studs now in the boiler. With this method of application the bevel seat for the boiler check can be made in the liner which will cover the original hole in the shell.

In applying this liner, the original liner on the inside of the shell should be removed. The liner illustrated in Fig. 2 is only for the application of a new boiler check and is not intended to be used for repairing cracks in the original boiler-check hole or any other defects at this point.

Disadvantages of Diamond-Shaped Seam

Q.—Although the diamond-shaped seam has greater efficiency than all other types of seams, it is seldom used for the longitudinal seam of a locomotive type boiler. Why?—W. F. H.

A.—Although the diamond-shaped seam has almost 100 per cent efficiency and would, therefore, appear to be the most advantageous because its use permits a reduction in the thickness of the shell and thereby reducing the weight and cost of the plates, construction details are such that these advantages cannot readily be obtained in practice.

As the inner welt of this type of seam has to be quite extensive in size, the weight saved in the shell itself is mostly replaced by the weight of the inner welt strip. The size of these welt strips is also a disadvantage in that it frequently causes the strip to interfere with some accessory or fitting requiring rivets or studs in the shell. Furthermore, holes through the seam in line with any of the seam rivets in the inner weld would reduce the efficiency of the seam which would defeat the purpose of using this type of seam.

The most practical type of longitudinal seams for use on locomotive boilers are the sextuple with 82 to 85 per cent efficiencies, the octuple with 87 to 93 per cent efficiencies and the decuple with 93 to 98 per cent efficiencies.

What Is Caustic Embrittlement?

Q.—What is caustic embrittlement?—E. R. M.

A.—Caustic embrittlement is the term applied to the chemical intercrystalline fracture of riveted seams in boilers. The features of these fractures in boilers are characteristic and well defined, and for all practical purposes are independent of the quality of steel employed in their construction.

They are: (1) The cracking is confined to the riveted seams. The plates away from the seams are unaffected. Joints above and below the water level are equally liable to have this form of cracking. (2) The cracking begins at rivet holes and on the surfaces in contact, not at the outside surfaces. (3) The cracking of the plates is usually accompanied by the breaking off or cracking of the rivet heads, and this is usually the first observable symptom. (4) The path of the cracks is along the grain boundaries and is not transcrystalline as is the case with fatigue failure.

Saturated and Superheated Steam

Q.—What is the difference between saturated and superheated steam, and what is wet and dry steam? Can superheated steam be wet or dry steam?—W. I. D.

A.—Saturated steam is steam in contact with the liquid water from which it was generated at a temperature which is the boiling point of the water and the condensing point of the steam. Dry saturated steam is steam free from mechanically mixed water particles. Wet saturated steam on the other hand contains water particles in suspension. Saturated steam at any pressure has a definite temperature.

Superheated steam is steam at any given pressure which is heated to a temperature higher than the temperature of saturated steam at that pressure. Water cannot exist in superheated steam. Therefore, all superheated steam is dry steam.

Recommended Practice for Smokebox Areas

Q.—In checking the smokebox areas of a Mikado type engine, where the areas are based on the cross-sectional area of the tubes and flues, should the area of the superheater units be deducted from the flue area or should the total flue area be taken? What is the recommended practice for smokebox areas?—J. B. S.

A.—The smokebox areas (or gas area for draft) should be based on the net cross-sectional area of the tubes and flues. This equals the sum of (1) the total internal cross-sectional area of all tubes and (2) the total internal cross-sectional area of all flues minus the total external cross-sectional area of all superheater units. Superheater bands and supports are not considered as limiting the cross-sectional area of the flues.

Example:

Given, a boiler having forty 5⅜-in. O. D. flues, No. 9 B. W. G. thick, and two hundred fifty, 2-in. O. D. tubes, No. 12 B. W. G. thick. The boiler is equipped with a type *A* superheater.

The internal area of the 5⅜-in. flue is 20.26 sq. in. The internal area of each 2-in. tube is 2.49 sq. in. Superheater units are of 1½-in. O. D. seamless steel, No. 10 B. W. G. thick. Each unit is composed of four pipes. The external area of one pipe = 1.77 sq. in.

$$1.77 \times 4 = 7.08 \text{ sq. in. per unit}$$

Total cross-sectional area of tubes and flues:

$$250 \times 2.49 = 622.5 \text{ sq. in.}$$
$$40 \times (20.26-7.08) = 527.2$$
$$\text{Total} = 1{,}149.7 \text{ sq. in.}$$

The A. A. R. recommends smokebox areas for the Master Mechanics' front end based on the net cross-sectional area of the tubes and flues representing 100 per cent, as follows:

Gas Area	Permissible, per cent	Preferred, per cent
Minimum net gas area through tubes and flues	100	100
Net gas area over arch	110-120	115
Maximum gas area under table plate	95-110	95
Minimum gas area under table plate	80- 95	85
Area under draft sheet	65- 80	75
Net area through netting	110-140	130
Minimum area of stack	23- 27	25

(*Turn to next left-hand page*)

High Spots in

Railway Affairs . . .

Railroads Transport Military Personnel

While it has not attracted much attention, the railroads are being called upon to transport large numbers of officers and men of the Army, Civilian Conservation Corps, Marine Corps and Navy, as well as draftees. A statement from the Association of American Railroads indicates that more than 207,000 officers and men were transported in January "without the slightest difficulty or interference with other traffic." While many of these men were transported on regular trains, 385 special trains were required in that month.

C. of C. on Consolidations

A report on railroad consolidation has been made by the Transportation and Communication Department Committee of the Chamber of Commerce of the United States. It points out that the carriers "have both the need and opportunity now, as never before, to streamline their plant, cut away unnecessary trackage and service, and establish a practical working base on which they can hope to utilize their inherent advantages and earn a fair return under fair regulation of all competing forms of transportation." It points out that consolidation should facilitate abandonment of branch lines, which are no longer profitable and which frequently more than eat up the earnings of the main lines.

St. Lawrence Project

The Department of Commerce, at the request of President Roosevelt, is making a series of reports on the economic aspects of the St. Lawrence waterway and power project. The first of seven reports was made in February. It is entitled "History of the St. Lawrence Project," and is in the form of a 39-page document. It outlines the various governmental and other surveys of the St. Lawrence which have been made from time to time and discusses also the negotiations and treaty making efforts of the United States and Canada. In relation to national defense, it characterizes President Roosevelt's recent message to the St. Lawrence Seaway Conference as a dramatic presentation of the thought that the seaway, "long defended as a great improvement to facilitate normal trade relations, is even more important in times of emergency." At a press conference on February 11, President Roosevelt said that the St. Lawrence question is something for Congress to decide. He did not say, however, when he might again request Congress to consider it.

Mosquitos in London Subways

The use of the London subway or tube stations for air raid shelters and as sleeping quarters has had one unusual and quite unexpected result. Conditions have proved favorable to the propagation of mosquitos, and this not alone during the summer season, but during the entire year. There always have been shallow, stagnant pools of water, but otherwise conditions were unfavorable for the breeding of mosquitos. Now the all-night residents furnish an abundant food supply, the temperature is frequently above 70 deg. F., and there is an absence of all natural enemies. This makes possible the continuous breeding throughout the year. Steps are being taken to overcome this nuisance by spraying with the proper chemicals.

Export Traffic Handled Efficiently

Railroaders still recall with feelings of discomfort the traffic congestion at the ports during the first World War. That advantage is being taken from the lessons learned at that time is indicated by the facility with which the railroads are now able to unload their freight cars and keep them on the move. In January of this year, for instance, 41,909 cars of export freight, other than grain, were unloaded at Atlantic and Gulf ports. Only 2,012 cars of grain for export were unloaded in the same month, as compared with 6,208 last year. Ralph Budd, Transportation Commissioner of the National Defense Advisory Commission, made the statement in an official bulletin of that Commission that "during 1940, increases in export movement through certain North Atlantic ports —as high as 100 per cent over 1939 levels and approximately equaling the 1918 peak —have been handled without congestion and without undue detention of loaded freight cars or overcrowding of terminal facilities." This has been made possible by the close and intelligent co-operation exercised by the government departments, the national defense organization and the Association of American Railroads.

Vacations with Pay

About 750,000 employees of 14 non-operating railroad unions have received ballots to vote on the question of striking to enforce their demand for two weeks' vacation with pay. George M. Harrison, president of the Brotherhood of Railway Clerks, is heading up the fight. After a visit to the White House he indicated that he had laid the situation before the President, expressing "our regret over the necessity for pursuing the case in this manner in view of the defense situation"; but "there is no other course." If the vote favors a strike, Mr. Harrison expects the case to go to an emergency board appointed by the President. That board would have 30 days to make its report and status quo must be maintained for 30 days after the making of the report. Mr. Harrison estimates that the granting of these demands will cost the railroads about $38,000,000 a year.

Grade Crossing Accidents

During 1940 there were 1,814 fatalities resulting from accidents at highway-railroad grade crossings, according to the Safety Section of the Association of American Railroads. This is greater than in any year since 1930, except for 1937 when there were 1,875 such fatalities. It marks an increase of 416 over 1939 and 297 compared with 1938. The increase is said to be due largely to the fact that more trains and automobiles were in operation. That many of these accidents are due to gross carelessness and thoughtlessness is indicated by the fact that about 80 per cent of them involved motorists at crossings in the vicinity of their homes.

Transport-Study Board

Although the Transportation Act of 1940 directed the President to appoint a study board, no progress seems as yet to have been made in that respect. While Congress regarded this as a vital matter, the railroads apparently must patiently await their turn until the powers that be get ready to act. It has been suggested that Owen D. Young, the retired chairman of the General Electric Company, who is directing the National Resources Planning Board's transportation study, would be an ideal man to head up the new board. It is understood, however, that he does not care to function in that capacity. The National Resources Board has made some considerable progress in its studies and there is a possibility that these may be available for the use of the new board which is required by the Transportation Act.

(Turn to second left-hand page)

Among the Clubs and Associations

New York Railroad Club.—Meeting held February 20. Speaker: S. C. Johnson, assistant vice-president, Dearborn Chemical Company. Subject: The Behavior of Steam and Water in a Locomotive Boiler, illustrated by motion pictures of a boiler interior taken from the dome of a locomotive operating in fast freight service on the Missouri Pacific. Motion picture entitled "What Happens in a Locomotive Firebox?" Introductory remarks and explanatory comment by A. A. Raymond, superintendent fuel and locomotive performance, New York Central.

North American Airbrake Association.—The North American Airbrake Association was organized at a recent meeting in Parsons, Kan., by representatives of ten railroads and industries from Missouri, Kansas, Oklahoma, Illinois, and Nebraska. The program adopted for 1941 calls for a meeting at Kansas City in May and an annual meeting at Springfield, Mo., in September. Officers elected were as follows: President, W. E. Vergan, supervisor of airbrakes of the Missouri-Kansas-Texas; first vice-president, A. Malmgren, traveling fireman of the St. Louis-San Francisco; second vice-president, L. S. Bean, airbrake room foreman of the Missouri-Kansas-Texas; third vice-president, C. B. Tramblie, airbrake supervisor of the Chicago, Burlington & Quincy, and secretary-treasurer, C. R. Ehni, mechanical inspector of the St. Louis-San Francisco.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

Allied Railway Supply Association.—J. F. Gettrust, P. O. Box 5522, Chicago.

American Society of Mechanical Engineers.—C. E. Davies, 29 West Thirty-ninth street, New York.

Railroad Division.—C. L. Combes, *Railway Mechanical Engineer*, 30 Church street, New York City.

Machine Shop Practice Division.—Warner Seely, Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, Ohio.

Materials Handling Division.—F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

Oil and Gas Power Division.—L. N. Rawley, Jr., Power, 330 West Forty-second street, New York.

Fuels Division.—D. C. Weeks, Consolidated Edison Co., 4 Irving Place, New York.

Anthracite Valley Car Foremen's Assn.—Exec. sec., Walter B. Riggin, 215 Swartz street., Dunmore, Pa. Meets third Monday of each month at Wilkes-Barre, Pa.

Association of American Railroads.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.

Operating Section.—J. C. Caviston, 30 Vesey street, New York.

Mechanical Division.—A. C. Browning, 59 East Van Buren street, Chicago. Meeting at Hotel Jefferson, St. Louis, Mo., June 19 and 20.

Purchases and Stores Division.—W. J. Farrell, 30 Vesey street, New York.

Motor Transport Division.—George M. Campbell, Transportation Building, Washington, D. C.

Canadian Railway Club.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

Car Department Association of St. Louis.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis, Mo.

Car Department Officers' Association.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago. Annual meeting September 22, 23 and 24, 1941.

Car Foremen's Association of Chicago.—G. K. Oliver, 8238 S. Campbell avenue, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

Car Foremen's Association of Omaha, Council Bluffs and South Omaha Interchange.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

Central Railway Club of Buffalo.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

Eastern Car Foremen's Association.—W. P. Dizard, 30 Church street, New York. Regular meetings, second Friday of January, February, March, April and October at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

Indianapolis Car Inspection Association.—R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

International Railway Fuel Association.—See Railway Fuel and Traveling Engineers' Association.

International Railway General Foremen's Association.—See Locomotive Maintenance Officers' Association.

Locomotive Maintenance Officers' Association.—J. E. Goodwin, general foreman, locomotive department Missouri Pacific, North Little Rock, Ark. Meeting September 22, 23 and 24, 1941.

Master Boiler Makers' Association.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Annual meeting September 22, 23 and 24, 1941.

New England Railroad Club.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September.

New York Railroad Club.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

North American Airbrake Association.—C. R. Ehni (secretary-treasurer), mechanical inspector, St. Louis-San Francisco, Springfield, Mo.

Northwest Car Men's Association.—E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

Northwest Locomotive Association.—G. T. Gardell, 820 Northern Pacific Building, St. Paul, Minn. Meetings last Monday of each month, except June, July and August.

Pacific Railway Club.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Monthly meetings alternately in northern and southern California.

Railway Club of Pittsburgh.—J. D. Conway, 1647 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

Railway Fuel and Traveling Engineers' Association.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago. Annual meeting, September 22, 23 and 24, 1941.

Railway Supply Manufacturers' Association.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa.

Southern and Southwestern Railway Club.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

Toronto Railway Club.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto, Ont.

Traveling Engineers' Association.—See Railway Fuel and Traveling Engineers' Association.

Western Railway Club.—W. L. Fox, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

* * *

An ACF-built combat tank being loaded into an end-door box car by means of a ramp

NEWS

Santa Fe Diesel Locomotive Freight Run

The new 5,400-hp. Diesel-electric freight locomotive, recently delivered to the Atchison, Topeka & Santa Fe by the Electro-Motive Corporation, General Motors subsidiary, La Grange, Ill., and placed in regular main-line freight service at Argentine, Kan., on Feb. 5, completed its first run to Los Angeles, Calif., on February 8. In handling this freight train the Diesel-electric locomotive demonstrated notably reliable performance, ample power to haul the train up heavy grades, and ability by means of the dynamic braking feature to ease the train down heavy grades with substantially less air-brake application and attendant wheel heating and brake-shoe wear.

The test was witnessed by responsible officers and engineers of both the railway and the locomotive builders and press representatives, who were accommodated in five business cars coupled back of the locomotive and dynamometer car and just ahead of the mixed freight cars and caboose which constituted the rest of the train. No special attempt was made for a speed record, the usual number of delays for passenger and other train meets being encountered.

The train consisted of between two and three thousand tons in a varying number of cars from 49 to 68, and was handled a distance of 1,782 miles from Argentine, to Los Angeles, in 55 hrs. running time. The average speed was 32.5 m. p. h., maximum speed 65 m. p. h., maximum drawbar horsepower, 4,400; gross ton-miles in thousands, 5,181; fuel consumption per mile, 6.05 gallons.

Dynamic braking was used at four places during the run for a total of 83 miles. Maximum grades ranged from 1.27 to 3 per cent. At a speed of 20 m. p. h. the retarding effect exerted was 48,000 lb. and the horsepower 2,560. At 29 m. p. h. the corresponding figures were about 35,000 lb. and 2,730 hp.

Where the dynamic retarding brake was used, it was necessary to set the train air brakes only about one fourth as much as usual. There was no evidence of excessive wheel heating throughout the run and when stops were made after descending heavy grades, the wheels never much exceeded bare hand temperature. The total energy absorbed by the dynamic brake during its use on this run is estimated at nineteen billion seven-hundred million foot pounds, or approximately 10 per cent of the energy used to move the train during the entire run.

The locomotive is 193 ft. long from coupler to coupler, weighs 464 tons with fuel and sand and has a tractive force of 220,000 lb. at starting. The power plant consists of four 16-cylinder General Motors' two-cycle Diesel engines, a generator directly coupled to each engine and 16 traction motors of which one is located on each of the 16 axles of the eight four-wheel trucks.

Orders and Inquiries for New Equipment Placed Since the Closing of the February Issue

LOCOMOTIVE ORDERS

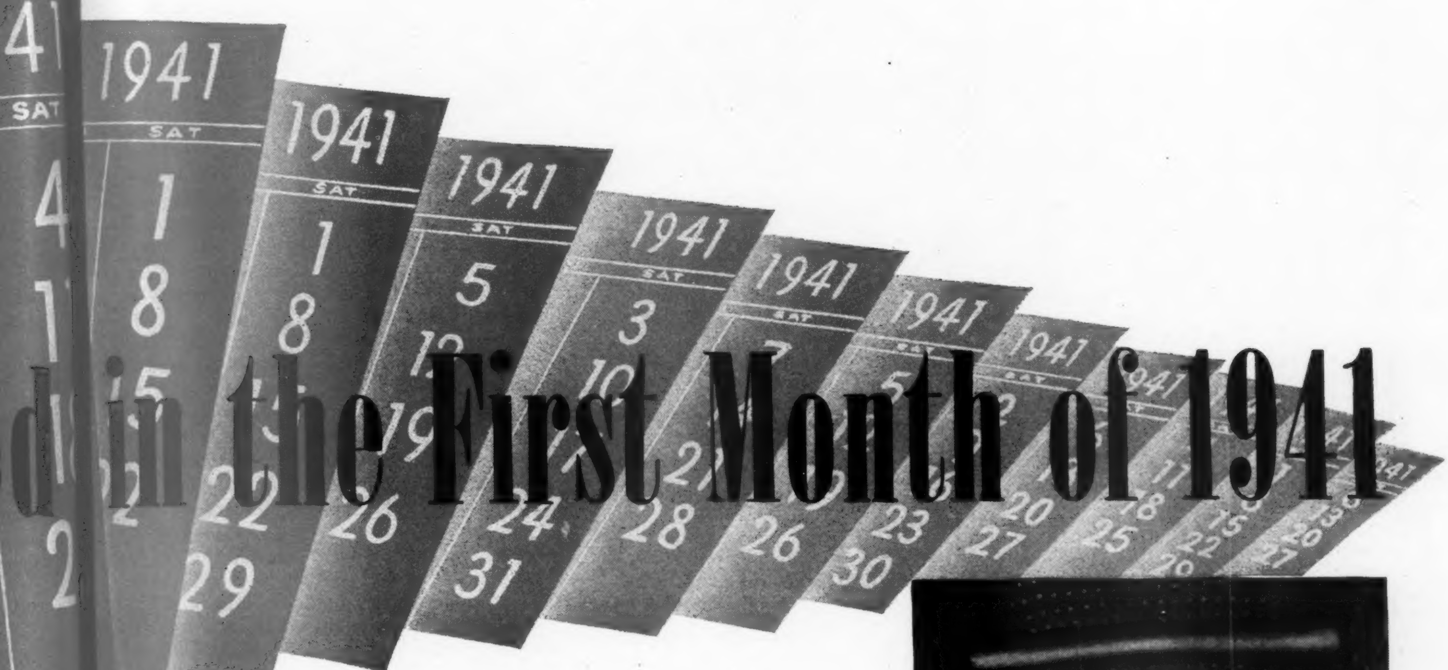
Road	No. of Locos.	Type of Loco.	Builder
Chesapeake & Ohio	8	4-6-4	Baldwin Loco. Wks.
	2	4-8-4 (J3a)	Lima Loco. Wks.
Chicago, Burlington & Quincy[1]	5	360-hp. Diesel-elec.	General Electric
	6	600-hp. Diesel-elec.	Electro-Motive Corp.
	15	1,000-hp. Diesel-elec.	
	4	2,000-hp. Diesel-elec. pass.	
Denver & Rio Grande Western	5	4-6-6-4	Baldwin Loco. Wks.
Detroit, Toledo & Ironton	4	2-8-2	Lima Loco. Wks.
Maine Central	2	1,600-hp. Diesel-elec.	American Loco. Co.
		1,380-hp. Diesel-elec.	General Electric
Missouri Pacific[2]	1	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	3	600-hp. Diesel-elec.	
	1	1,000-hp. Diesel-elec.	American Loco. Co.
	2	600-hp. Diesel-elec.	Baldwin Loco. Wks.
	5	360-hp. Diesel-elec.	General Electric
	3	360-hp. Diesel-elec.	Whitcomb Loco. Wks.
	3	360-hp. Diesel-elec.	Davenport-Besler Corp.
Northern Pacific	3	1,000-hp. Diesel-elec.	Electro-Motive Corp.
	2	1,000-hp. Diesel-elec.	American Loco. Co.
	2	1,000-hp. Diesel-elec.	Baldwin Loco. Wks.
Pere Marquette	12	2-8-4	Lima Loco. Wks.
Southern Pacific[3]	8	600-hp. Diesel-elec.	Electro-Motive Corp.
	5	660-hp. Diesel-elec.	American Loco. Co.
	2	600-hp. Diesel-elec.	Baldwin Loco. Wks.
Union Pacific	5[4]	4-8-8-4	American Loco. Co.

LOCOMOTIVE INQUIRIES

Road	No. of Locos.	Type of Loco.	Builder
Grand Trunk Western	20	4-8-4	....

(*Continued on page 120*)

Santa Fe 5,400-hp. Diesel-electric freight locomotive

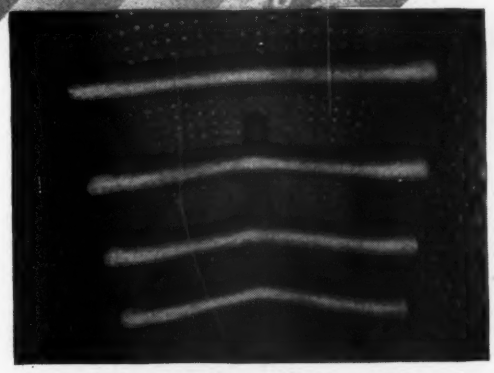


d in the First Month of 1941

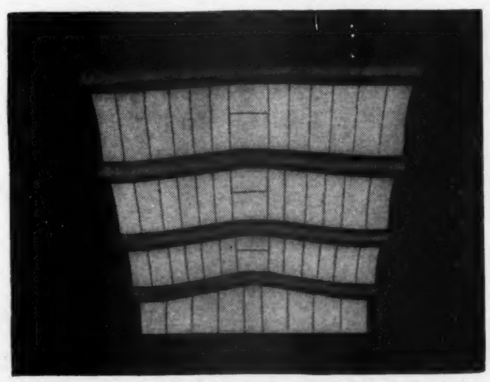
In the month of January, alone, the American Arch Company received orders for 196 Security Circulators to be installed on 30 locomotives. This is graphic evidence of railroad approval of The Security Circulator.

The performance record of the 660 units that have been installed during the last six years is responsible for the trend towards Security Circulators.

As the Security Circulator is adaptable to any type of locomotive you can improve the efficiency and decrease the maintenance of your old, as well as your new, locomotives.



View illustrating the positioning of Security Circulators in an average size of locomotive firebox prior to installing the brick arch.



Typical Security Circulator and brick Arch Installation in a locomotive firebox. The small sectional brick are as readily applied as in an ordinary arch tube firebox.

ARCH COMPANY, INC.

Security Circulator Division

FREIGHT-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Bessemer & Lake Erie	5	90-ton hopper	Pull.-Std. Car Mfg. Co.
Chesapeake & Ohio	250	50-ton box	American Car & Fdry. Co.
	250	50-ton box	Gen. American Trans. Corp.
	250	50-ton box	Pull.-Std. Car Mfg. Co.
	250	50-ton box	Mt. Vernon Car Mfg. Co.
	50	50-ton flat	Bethlehem Steel Co.
Chicago & North Western	750	50-ton gondolas	Gen. Amer. Transp. Corp.
	250	50-ton gondolas	Bethlehem Steel Co.
	200	70-ton ore	
	500	50-ton box	Pull.-Std. Car Mfg. Co.
Chicago, Burlington & Quincy	250	Ballast[1a]	Rodger Ballast Car Co.
	200	55-ton hopper	[1a] Company shops
	1,500	50-ton box	
	225	Auto parts cars	
	100	Flat	[1b] Company shops
	250	Box	
	300	Stock	[1c] Company shops
	500	Box	
Grand Trunk Western	200	70-ton gondolas	Magor Car Corp.
	100	70-ton flat	Greenville Steel Car Co.
	300	40-ton automobile	Pressed Steel Car Co.
Linde Air Products Co.	20	70-ton box	Pressed Steel Car Co.
McKeesport Connecting	100	70-ton low-side gondolas	American Car & Fdry. Co.
Missouri Pacific[2]	400	55-ton hopper	American Car & Fdry. Co.
	2	125-ton well	
	400	55-ton hopper	Mt. Vernon Car Mfg. Co.
	70	55-ton covered hopper	
	400	55-ton hopper	Bethlehem Steel Co.
Pacific Fruit Express	1,000	Refrigerator	Pacific Car & Fdry. Co.
Pere Marquette	40	Caboose	St. Louis Car Co.
St. Louis Refrig. Car Co.	35	Refrigerator	Company shops
Tennessee Coal, Iron & Railroad Co.	20	70-ton flat	Pull.-Std. Car Mfg. Co.
	20	70-ton gondolas	
	6	70-ton hot-hole	
Toronto, Hamilton & Buffalo	75	75-ton low-side gondolas	Nat'l. Steel Car Corp.
Union Pacific	300	50-ton flat	Pull.-Std. Car Mfg. Co.
	50	70-ton mill-type gondolas	
United States Navy Dept.	33	55-ton box	Greenville Steel Car Co.
United States War Dept.	20	40-ton box	Greenville Steel Car Co.
Virginian	100	50-ton box	Pressed Steel Car Co.

FREIGHT-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Ann Arbor	25	55-ton hopper	....
Atchison, Topeka & Santa Fe	10 or 12	50-ton box	....
Canadian National	250	70-ton hopper	....
	200	Flat	....
	150	Ballast	....
	125	80-ton ore	....
Minneapolis & St. Louis	75	Auto-box	....

PASSENGER-CAR ORDERS

Road	No. of Cars	Type of Car	Builder
Chicago, Rock Island & Pacific	3	Pass.	Edw. G. Budd Mfg. Co.
Missouri Pacific[2]	1	Rail-motor car	American Car & Fdry. Co.
New York Central	2	Mail and mail storage	[5] Edw. G. Budd Mfg. Co.
	2	Tavern-lounge-baggage	
	6	Parlor	
	4	Dining	
	16	Coaches	
	2	Obser.-buffet	

PASSENGER-CAR INQUIRIES

Road	No. of Cars	Type of Car	Builder
Chesapeake & Ohio	20	Coaches	....
Norfolk & Western	15	Coaches	....
Union Pacific	10, 15, 20 and 30	Baggage	....
	10 and 20	Mail-baggage	....
	10, 20, 25 or 30	Chair	....

[1] For the 30 Diesel-electric locomotives the C. B. & Q. plans to spend $2,437,279.

[1a] For the C. B. & Q. $6,481,000 has been allotted for this equipment.

[1b] For the Colorado & Southern. $985,000 has been allotted for this equipment.

[1c] For the Fort Worth & Denver City. $2,130,000 has been allotted for this equipment.

[2] The 18 Diesel-electric switching locomotives, the 1,272 freight cars, and the rail motor car involve an expenditure of $4,338,000.

[3] Total cost of order estimated at $900,000.

[4] In addition to 15 4-8-8-4 type locomotives ordered from the same builder as reported in the February issue.

[5] Equipment to be used for two trains to replace present Empire State Express which celebrates its fiftieth anniversary this year. To cost between $2,000,000 and $2,500,000. The new trains will be hauled by fully-streamlined steam locomotives of the Hudson-type of a design similar to that of the locomotives now hauling the Twentieth Century Limited. Details as to builder of locomotives have not as yet been made available.

Cornell Scholarships for Apprentices

THE College of Engineering, Cornell University, will receive applications until April 1 for the John McMullen industrial scholarships, which pay $400 a year for a four-year college course in engineering. Applicants must be high school graduates, must have served some time as workers of industry, preferably in a regular training course and must be recommended by their employers as men of special ability whose careers would be helped by a college course in civil, electrical, mechanical, or chemical engineering. Scholarships providing $600 per year and freedom from tuition fees for research graduate assistantships in engineering, including civil, electrical and mechanical engineering, railway engineering and theoretical and applied mechanics, have been offered by the Engineering Experiment Station of the University of Illinois, Urbana, Ill. Applications for these, however, closed on March 1.

Equipment Purchasing and Modernization Programs

Chicago & North Western.—The C. & N. W. has received permission from the district court to purchase freight and passenger equipment to cost approximately $7,500,000. The freight equipment includes 1,000 50-ton gondola cars, 500 50-ton 50-ft. box cars and 200 70-ton ore cars. The company is reported to have allocated 750 gondola cars to the General American Transportation Corporation and 250 gondola cars to the American Car and Foundry Co. The passenger equipment consists of five 2,000-hp. Diesel-electric locomotives, sixteen coaches, four combination baggage-tap room cars, three dining cars and two parlor cars. The railroad plans to use this equipment between Chicago and Wisconsin points and possibly some points in southern Minnesota.

The road has asked the Interstate Commerce Commission for authority to assume liability for $5,527,000 of equipment trust certificates, maturing in 10 equal annual installments on March 1 of each of the years from 1942 to 1951, inclusive. The proceeds will be used as part of the purchase price of the new equipment.

Chicago, Burlington & Quincy.—The C. B. & Q. will build a large number of freight cars in its own shops during 1941.

Chicago, Rock Island & Pacific.—The Rock Island has been authorized by the federal district court on February 10 to spend $7,797,058 for improvements during 1941. Of this amount, $6,583,232 is for betterments to roadway and structures, $844,576 is for improvements to equipment and $369,250 is for the purchase of new rolling stock. An allowance of $328,788 is made for improvements to shops and enginehouses and the installation of improved shop machinery and tools. The equipment program includes the purchase of 10 Diesel-electric switching locomotives, 5 of 30 tons and 5 of 44 tons, the application of roller bearings to locomotives and the enlargement of tanks and tenders. Automobile loaders will be installed in freight cars and 25 caboose cars will be built in company shops. In addition, the budget provides for the purchase of two streamline cars for overflow Rocket train travel.

Great Northern.—The Great Northern is rebuilding eight locomotives at its Hillyard, Wash., shops.

Illinois Central.—Division 4 of the Interstate Commerce Commission has amended its order in Finance Docket No. 13045 so as to permit this company to (1) substitute one 1,000-h.p. and two 2,700-h.p. Diesel-electric locomotives for three 2,000 h.p. Diesel transfer locomotives contemplated in the original order, and (2) purchase an additional 115 70-ton all-steel covered hopper cars at a cost of $447,750. The purchase of the additional cars was made possible because of price concessions given by the manufacturers on the other equipment authorized to be purchased.

Illinois Terminal.—The Illinois Terminal has asked the Interstate Commerce Commission for authority to assume liability for $560,000 of equipment trust certificates, maturing in 10 equal annual installments of $56,000 on February 15 in each of the years from 1942 to 1951, inclusive. The proceeds will be used as part payment for equipment costing a total of $706,000 and consisting of 250 50-ton all-steel box cars.

Minneapolis, St. Paul & Sault Ste. Marie.—The M., St. P. & S. S. M. has

(Continued on page 121)

asked the District court for permission to order 50 ballast cars from the American Car and Foundry Co., and 100 flat cars from the Pullman-Standard Car & Manufacturing Co.

New York Central.—This company has asked the Interstate Commerce Commission for authority to assume liability for $10,900,000 of equipment trust certificates, maturing in 10 equal annual installments of $1,090,000 on February 15 in each of the years from 1942 to 1951, inclusive. The proceeds will be used as part of the purchase price of new equipment costing a total of $12,173,885 and consisting of 200 70-ton steel flat cars, 600 55-ton steel box cars, 145 55-ton steel auto box cars, 100 55-ton end door box cars, 36 oil-electric switching locomotives, 95 all-steel passenger coaches, 16 all-steel passenger coaches, six all-steel parlor cars, four all-steel dining cars, two all-steel observation-buffet cars, two all-steel tavern-lounge-baggage cars, and two all-steel Railway Post Office mail and storage cars. The application points out that all the equipment enumerated following the 95 all-steel passenger coaches will be of stainless steel and will constitute equipment for two complete passenger trains.

New York, New Haven & Hartford.—The New Haven is contemplating the purchase of 1,000 box cars and 25 cabooses.

Northern Pacific.—This company has asked the Interstate Commerce Commission for authority to assume liability for $3,000,000 of equipment trust certificates, maturing in 10 equal annual installments of $300,000 on February 15 in each of the years from 1942 to 1951, inclusive. The proceeds will be used as a part of the purchase price of new equipment costing a total of $3,475,000 and consisting of eight two-cylinder 4-8-4 passenger and freight locomotives, six four-cylinder articulated 4-6-6-4 freight locomotives, three 1,000 hp. 125-ton Diesel-electric switching locomotives, two 1,000 hp. 120-ton Diesel-electric switching locomotives, and two 1,000 hp. 115-ton Diesel-electric switching locomotives.

Pacific Fruit Express.—The Pacific Fruit Express, subsidiary of the Union Pacific and Southern Pacific, has undertaken a 1941 improvement program involving an expenditure of about $15,500,000. Included is an order for 1,000 new refrigerator cars placed with the Pacific Car & Foundry Co. at a total cost of approximately $4,500,000. The company's maintenance program for the first half of 1941, involving the rebuilding and repair of more than 3,000 refrigerator cars at estimated cost of $11,000,000, provides for the reconstruction of 2,000 cars with entirely new bodies and latest type air brakes, heavy repairs to 1,000 cars and lighter repairs to others.

St. Louis-San Francisco.—The 1941 budget of the St. Louis-San Francisco calling for the expenditure of $1,114,853 has been approved by the federal district court. Of this amount $62,000 is for two 44-ton Diesel-electric switching locomotvies.

N. Y. C. 4-8-2 Locomotives—A Correction

The boilers of the New York Central 4-8-2 type Locomotives described in the January issue of the *Railway Mechanical Engineer* have Type E, 100 unit, double-loop superheaters with American throttles and not single-loop units as mentioned on page 3 of that article.

Supply Trade Notes

The Hulson Grate Company, Keokuk, Iowa, has opened a temporary demonstration office at 322 South Michigan avenue, Chicago.

◆

Milford J. Cross has been appointed representative in the western territory for the Hunt-Spiller Manufacturing Corporation, with headquarters in South Boston, Mass.

◆

James A. Curtis, sales representative of the Carnegie-Illinois Steel Corporation, with headquarters at Chicago, has been appointed sales manager of the Marquette Railway Supply Company, Chicago.

◆

Chicago Malleable Castings Company.—*W. L. Beaudway* has been appointed executive vice-president and *J. T. Llewellyn,* II, has become vice-president, of the Chicago Malleable Castings Company.

◆

Baldwin Locomotive Works.—*Stewart McNaughton* has been appointed special representative by the Baldwin Locomotive Works to act in an advisory capacity and assist the vice-president in charge of sales and the general sales manager. *C. A. Campbell,* formerly foreign sales manager, has become sales manager of the locomotive division. *C. G. Pinny,* formerly technical representative in South America, succeeds Mr. Campbell as foreign sales manager. *C. A. Bercaw* has been appointed sales manager for Diesel-electric locomotives, and *H. L. Weinberg,* chief service engineer, for Diesel-electric locomotives.

Alfred R. Walker, electrical engineer-equipment, Illinois Central, Chicago, has been appointed automotive sales engineer of the American Car and Foundry Co.,

A. R. Walker

with headquarters at New York. In his new position, Mr. Walker has to do with the development and promotion of rail-motor cars and Diesel-hauled streamline trains. Born in Pierceton, Ind., in 1892, Mr. Walker was educated at Goshen college and the University of Cincinnati, and entered railway service with the Winona Interurban during summer vacations. Following graduation, he taught high school for three years and was employed by steel mills in electrical work for seven years. In 1923, he entered the employ of the Illinois Central as a draftsman, later becoming inspector and junior and assistant engineer. In 1927 he became draftsman with Bylesby & Co., and a year later returned to the Illinois Central as electrical equipment engineer, later becoming electrical engineer-equipment. Mr. Walker served as chairman, Electrical Section, Mechanical Division, A. A. R., from 1937 to 1939.

◆

G. Donald Spackman, formerly general superintendent, has been appointed general manager of the Lukens Steel Company.

◆

A. C. Harvey Co., Allston, Mass., have been appointed jobbers of the line of Hobart multi-range arc welders to collaborate with Leo Gordon of the New England distributing office of the Hobart Brothers Company.

◆

The Superior Car Door Company Chicago, has been organized to acquire the steel car door and door fixture business of the Chicago Railway Equipment Company. The trade name "Creco" has been changed to "Superior."

◆

Earl E. Thulin, as western divisional manager, under the account of The Earl E. Thulin Company, 122 South Michigan avenue, Chicago, now represents the Joyce-Cridland Company, Dayton, Ohio, in its northwestern territory. Mr. Thulin was previously vice-president and general manager of sales of the Duff-Norton Manufacturing Company, with headquarters at Chicago. Mr. Thulin is a graduate of Lane Technical High School and Junior College, Chicago. During 1918 and 1919 he was with the Armour Car Lines Shops. In the latter year he joined the Duff-Norton sales organization.

Miller-Lewis Railroad Equipment Corp.—*John W. Miller* has been elected president, *Thomas E. Daley*, vice-president and *Francis Murphy*, secretary, of the Miller-Lewis Railroad Equipment Corporation, with headquarters in New York City. *J. F. McDonnell*, formerly connected with the New York Central, has been appointed manager of the company's Chicago branch.

◆

John F. Van Nort has been appointed sales manager, Western Division, of the Duff-Norton Manufacturing Company of

John Van Nort

Pittsburgh, Pa. Mr. Van Nort, who will be located at Chicago, was previously with a United States Steel Corporation subsidiary in various sales capacities in eastern territory.

◆

Lunkenheimer Company.—*Harry A. Burdorf*, vice president in charge of sales, and *Frank P. Rhame*, vice president in charge of sales engineering, have been elected to the board of directors of the Lunkenheimer Company.

◆

The Okonite Company, Passaic, N. J., on January 15, 1941, have opened a district office at 1212 Comer building, Birmingham, Ala. Dewey A. White, formerly sales engineer in the Atlanta office, and 17 years with Okonite, has been appointed manager of the new branch. The south central territory will include Tennessee, Alabama, Mississippi and Louisiana, and Mr. White will represent The Okonite Company, the Okonite-Callender Cable Co., Inc., and the Hazard Insulated Wire Works Division. The south Atlantic territory (North Carolina, South Carolina, Georgia and Florida) will continue to be covered by George N. Brown, manager of the Atlanta, Ga. office, 1606 Rhodes-Haverty building. The St. Louis, Mo., office of Okonite has been moved from the Ambassador building to larger quarters at 1406 Shell building. Robert E. Sontag remains in charge as manager.

◆

The DeVilbiss Company, manufacturers of spray-painting equipment, exhaust systems, air compressors and hose, have opened a sales and service office at 1280 West Washington Boulevard, Chicago.

◆

W. A. Cather has been placed in charge of market research and related activities for the Seamless Steel Tube Institute, 3510 Gulf, Pittsburgh, Pa. Mr. Cather will operate out of the Institute's office in Pittsburgh and the offices of the Michel-Cather organization at 2 Park avenue, New York.

◆

W. E. Hedgcock, acting head of the Sales department of American Car and Foundry Co. since March 29, 1940, has been appointed vice-president in charge of sales, with full authority as to the direction of the affairs and of the personnel of that department.

Obituary

John Roberts, retired engineer of the transportation department of the General Electric Company, Schenectady, N. Y., died on January 28 at his home in Schenectady at the age of 69 after a short illness.

◆

George N. DeGuire, assistant to the president and a director of the Locomotive Firebox Company, died on January 26 at his home in New Rochelle, N. Y. , at the age of 56. At the time of his death he was also a member of the executive staff of The Oxweld Railroad Service Company (unit of the Union Carbide & Carbon Corp.); president, Ajax Hand Brake Company; and vice-president and a director of the O. C. Duryea Corporation. His headquarters were at New York. Mr. DeGuire was born in Appleton, Wis., in 1884, and was educated in high school and in special business courses. In 1900 he entered railroad service with the Chicago & North Western as a fireman at the age of sixteen, later becoming locomotive engineer and special member of the mechanical department, successively. In 1916, he was assigned to special duties in the Interstate Commerce Commission. In 1918 Mr. De-

George N. DeGuire

Guire became assistant manager of the Department of Equipment, United States Railroad Administration, later becoming manager, which post he held until 1923.

◆

R. N. Baker, assistant manager of the railway department of the Chicago office of the Okonite Company, died January 3 after a brief illness. He was 69 years old.

Personal Mention

General

John Burns, works manager of the Canadian Pacific at Montreal, Que., has retired because of ill health. Mr. Burns has been works manager for more than 21 years.

W. S. Mosely, mechanical engineer of the Clinchfield, with headquarters at Erwin, Tenn., has been appointed also assistant to the general manager.

M. R. Benson, master mechanic on the Michigan Central at St. Thomas, Ont., has been appointed to the newly created position of assistant superintendent of equipment.

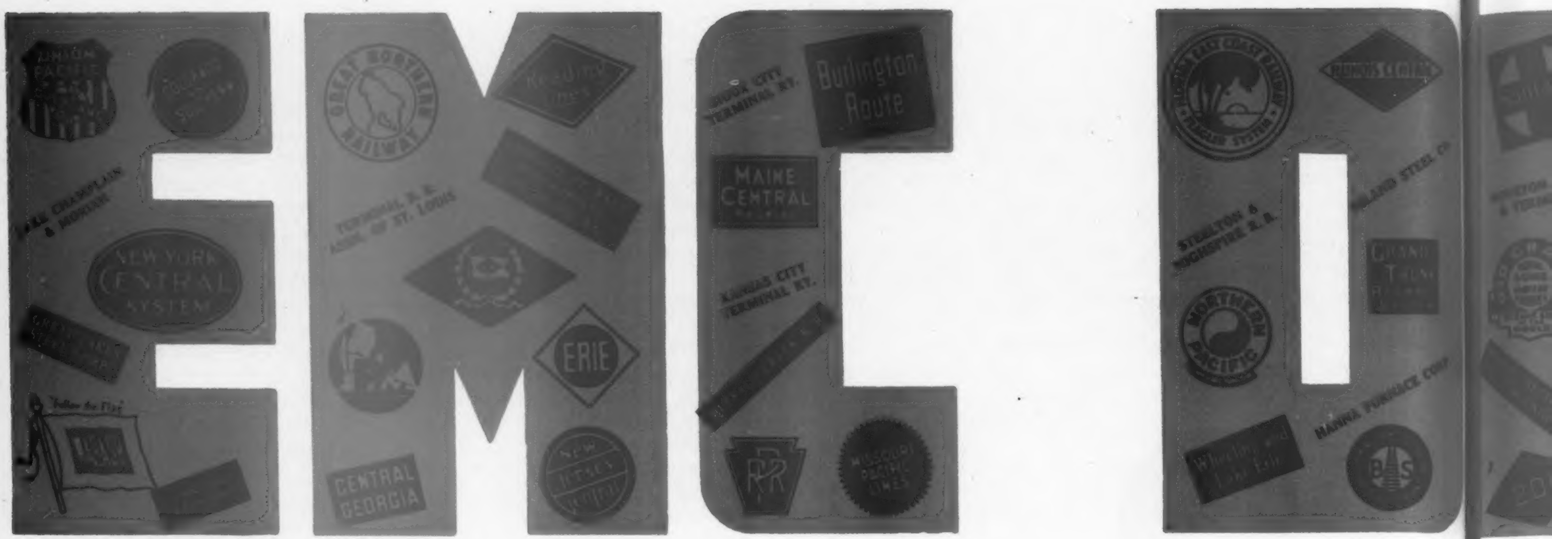
Frank Kenneth Mitchell, assistant to general superintendent motive power of the New York Central, has been promoted to assistant general superintendent motive power and rolling stock, with headquarters as before at New York.

Bernard Faughman, general freight car foreman at the Angus shops, of the Canadian Pacific, has been promoted to assistant works manager.

A. L. Wright, superintendent of shops of the Boston & Albany at West Springfield, Mass., has been appointed assistant to general superintendent of motive power of the New York Central system, with headquarters at New York.

Harry W. Jones general superintendent of the Eastern Pennsylvania division at Harrisburg, Pa., has become appointed chief of motive power of the Pennsylvania at Philadelphia, Pa. Mr. Jones was born at Northumberland, Pa., on December 30, 1884, and entered railway service with the Pennsylvania as a machinist apprentice in the Sunbury, Pa., shops in 1903. In 1908, he was appointed assistant enginehouse foreman at Sunbury, becoming enginehouse foreman at Renovo, Pa., in 1911 and shop inspector in the office of the superintendent of motive power at Williamsport, Pa., in 1912. In 1913, he was appointed general foreman of the Olean (Pa.) shops, which position he held until 1915 when he was appointed shop inspector in the office of the general superintendent of motive power at Altoona, Pa. Mr. Jones was appointed assistant master mechanic at Wilmington,

(*Continued on page 123*)



70 Railroads and Heavy Industries

THE acid test of any development is its demonstrated adaptability, reliability and economy. Success is measured by growth. The rapid progress made by EMC Diesels as reflected in the ever increasing number of users is most significant. In six years over 480 EMC Switchers and 140 EMC units of road power have been placed in service by 70 railroads and industrial companies throughout the country.

What finer tribute to EMC Diesel leadership in reliability, economy, high availability, safety, increased passenger traffic and lower operating costs.

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Complete Dieselization Most Economical

IN line with the established policy to pre-prove thoroughly each new type of equipment before offering it to the railroads, Electro-Motive Corporation built a 5400 hp. Diesel locomotive for test in freight service. This locomotive operated over 80,000 miles in actual service on 20 leading railroads from coast to coast, both as a 2700 hp. single unit and as a 5400 hp. double unit.

The marked increases in tonnage handled on existing schedules, the ability to shorten schedules and decrease the number of locomotives required, and other outstanding advantages and economies, proved conclusively that the EMC Diesel Freight Locomotive, in addition to EMC Diesels for switching, transfer and passenger service, now makes possible the complete Dieselization of any railroad.

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Del., in 1917 and served as master mechanic at Sunbury and Renovo from 1918 until 1921, when he was transferred to the Juniata shops at Altoona. In 1929 he went

Harry W. Jones

to Pittsburgh, Pa., as superintendent motive power, Western Pennsylvania division, and in 1930 became general superintendent motive power of the Central region at Pittsburgh, going to Indianapolis, Ind., in 1933 as general superintendent of the Southwestern division. In 1937 he was transferred to the Eastern Pennsylvania division at Harrisburg, Pa.

R. G. BENNETT, general superintendent of motive power of the Eastern region of the Pennsylvania, has been appointed assistant chief of motive power, with headquarters as before at Philadelphia, Pa. Mr. Bennett was born on March 31, 1882, at Brighton, England, and was graduated from Purdue University in 1908 with the degree of bachelor of science in mechanical engineering, receiving his mechanical engineering degree in 1915. He entered railway service in January, 1900, as a machinist apprentice on the Pennsylvania at Erie, Pa., and completed his apprenticeship in 1904 at the Renovo (Pa.) shops. While attending college, Mr. Bennett was employed during summer months as a ma-

Robert George Bennett

chinist, draftsman and inspector on the Pennsylvania. In November, 1908, he was appointed motive power inspector of the Monongahela division, holding that position until March, 1912, when he became rodman in the maintenance of way department, Pittsburgh division. He was appointed inspector in the test department in March, 1913, in charge of the locomotive test plant at Altoona, Pa. In May, 1916, Mr. Bennett became assistant master mechanic on the Cumberland Valley (part of the Pennsylvania) at Chambersburg, Pa., and in February, 1917, was appointed assistant engineer of motive power of the Central division of the Pennsylvania at Williamsport, Pa. He was appointed master mechanic at Sunbury, Pa., in July, 1917, and in May, 1918, was transferred to the Pittsburgh (Pa.) division. He was promoted to superintendent of motive power of the Central Pennsylvania division at Williamsport, Pa., in December, 1919, and in June, 1924, was transferred to the Eastern Ohio division at Pittsburgh. In April, 1925, he became general superintendent of motive power of the Southwestern region, at St. Louis, Mo., and in June, 1925, was transferred to the Eastern region.

WARREN ROBERT ELSEY, mechanical engineer of the Pennsylvania, at Philadelphia, Pa., has been appointed general superintendent of motive power, Eastern region, with headquarters at Philadelphia. Mr.

Warren Robert Elsey

Elsey was born on April 1, 1892, at Pittsburgh, Pa., and was graduated from the Carnegie Institute of Technology in 1910. He entered railway service on September 26, 1911, as a draftsman on the Pennsylvania at Pittsburgh and served in this capacity until March 16, 1916, when he became piecework inspector at Shire Oaks, Pa. On July 16, 1917, he was appointed shop inspector, with headquarters at South Pittsburgh, Pa., becoming assistant master mechanic at Canton, Ohio, on April 1, 1920, and motive power inspector of the Western Pennsylvania division on March 1, 1921. Mr. Elsey was appointed assistant master mechanic at Conemaugh, Pa., on February 1, 1923. On February 1, 1928, he was promoted to the position of master mechanic at Baltimore, Md. From January to December, 1929, he was acting superintendent of floating equipment at Jersey City, N. J., then becoming superintendent of floating equipment there. He was appointed mechanical engineer at Philadelphia on October 1, 1936.

C. K. STEINS, assistant chief of motive power-locomotive of the Pennsylvania, at Philadelphia, Pa., has been appointed mechanical engineer with headquarters at Philadelphia. Mr. Steins was born at East Orange, N. J., on February 21, 1891, and

Carleton K. Steins

was graduated from the Stevens Institute of Technology in 1913 with a degree in mechanical engineering. He entered railway service in July, 1913, as special apprentice in the motive power department of the Pennsylvania and was furloughed for military service in 1917, serving overseas with the 19th Engineers as first lieutenant. In May, 1919, he returned to the Pennsylvania as assistant master mechanic, New York division, and subsequently became assistant engineer of motive power at New York, Harrisburg, Pa., and Philadelphia. In 1928, Mr. Steins was appointed master mechanic at Indianapolis, Ind., and in 1929 was transferred to Wilmington, Del. In April, 1937, he became assistant chief of motive power—locomotive.

H. L. NANCARROW, superintendent of the Pittsburgh division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been promoted to general superintendent of the Lake division, with headquarters at Cleveland, Ohio. Mr. Nancarrow was born on January 13, 1897, at Jersey Shore, Pa. He received his mechanical engineer-

Harry L. Nancarrow

ing degree from Bucknell University in 1920, and entered railway service on October 7, 1920, as a draftsman in the office of the superintendent of motive power of

the Pennsylvania at Philadelphia, Pa. On March 14, 1921, he was appointed special apprentice at the Altoona machine shops, becoming inspector of motive power there on April 17, 1924. He was appointed gang foreman on the Cleveland division on September 1, 1924, and assistant enginehouse foreman on February 10, 1926. On March 1, 1927, he became assistant master mechanic on the Akron division, being promoted to master mechanic of the Erie & Ashtabula division on May 16, 1928. On January 1, 1929, he was transferred to the Baltimore division and later to the Philadelphia Terminal division. On September 16, 1936, he became superintendent of the Logansport division, being transferred to the Buffalo division on January 16, 1938. He became superintendent passenger transportation of the Eastern Region at Philadelphia, on May 1, 1939, and superintendent of the Pittsburgh division at Pittsburgh, Pa., on January 16, 1940.

Edward Greig Bowie, who has been appointed superintendent of the motive power and car departments of the Western lines, with headquarters at Winnipeg, Man., as announced in the February issue, was born in Winnipeg on August 20, 1892, and

Edward Greig Bowie

entered railway service on June 25, 1907, as a clerk in the traffic department of the Canadian Pacific. On March 15, 1909, he became a machinist apprentice and from April 7, 1913, to March 15, 1914, served also as an assistant dynamometer-car operator. On the latter date he became a machinist at Winnipeg and later served successively as a clerk in the mechanical department at Calgary, Alta., iron machinist in the car department at Montreal, Que., inspector in the locomotive department, machinist and dynamometer-car operator. On December 10, 1915, he was promoted to the position of assistant foreman in the locomotive department at Ottawa, Ont., and on May 18, 1916, was transferred to Outremont, Que. Mr. Bowie became locomotive foreman at Sherbrooke, Que., on November 9, 1916, was transferred to Smith's Falls, Ont., on March 1, 1917, and advanced to general foreman at McAdam, N. B., on June 1, 1918. On April 1, 1920, he was appointed division master mechanic at Brownville Junction, Me., and later was transferred to Schreiber, Ont., and London, Ont. On January 1, 1928, he became district master mechanic, with headquarters at North Bay, Ont., later being transferred successively to Moose Jaw, Sask., and Vancouver, B. C. Mr. Bowie was appointed works manager of the Ogden shops at Calgary on July 1, 1936, and assistant superintendent of motive power on October 16, 1937.

H. R. Naylor, assistant works manager, car department, Canadian Pacific, with headquarters at Montreal, Que., has been promoted to works manager, Angus shops with headquarters at Montreal, Que. Mr.

H. R. Naylor

Naylor was born in Hull, England, and served an apprenticeship with the North Eastern Railway. He joined the Canadian Pacific in 1907 as patternmaker in the Angus shops and later worked in the drawing office. In 1911 he became steam-heat inspector and in 1912 went to West Toronto as general foreman of the passenger car shops, returning to Montreal in 1913 as divisional car foreman of the eastern division, now Quebec district. Mr. Naylor returned to the Angus shops in 1915 as supervisor of piecework and in 1918 was attached to the chief mechanical engineer's staff at Windsor Station. He was appointed general car foreman of freight car work in 1919 and assistant works manager, car shops, in 1920.

Obituary

Eliot Sumner, who retired in 1937 as assistant to general superintendent motive power of the Eastern region of the Pennsylvania at Philadelphia, Pa., died of a heart attack on January 29 at his home in Essex Falls, N. J., at the age of 67. Mr. Sumner was born on October 18, 1873, at New Haven, Conn., and received his education at Yale University. He entered railway service in 1896 as a machinist apprentice at the Altoona, Pa., shops of the Pennsylvania, later serving until 1901 as an inspector, Philadelphia division. In 1901, he was appointed assistant master mechanic, Middle and Western divisions and in 1902, assistant engineer of motive power, Buffalo and Allegheny Valley division; from 1903 until 1907 he was in the office of general superintendent of motive power. In 1907 he was appointed master mechanic, Baltimore division; in 1911, master mechanic, Williamsport division; in December, 1913, master mechanic, West Philadelphia shops. In July, 1916, superintendent of motive power, Williamsport, Pa., in May, 1918, superintendent of motive power, New Jersey division, with headquarters at New York and in 1928, assistant to general sup-

Eliot Sumner

erintendent of motive power of the Eastern region at Philadelphia. Mr. Sumner was a member of the Executive Committee of the American Society of Mechanical Engineers, from 1927 to 1930 and chairman in 1931. From 1928 to 1930 he was president of the New York Railroad Club.

Ray M. Brown, assistant to general superintendent of motive power of the New York Central, at New York, who died on January 17, as announced in the February issue, was born on April 9, 1879, at Ashtabula, Ohio. He entered the service of the Lake Shore & Michigan Southern (now New York Central) as machinist apprentice at Cleveland, Ohio, in 1899, and subsequently served on that road as draftsman, apprentice instructor, chief draftsman and assistant engineer of motive power. From 1915 to 1924, Mr. Brown was assistant engineer and engineer of motive power

Ray M. Brown

of the New York Central at New York, then becoming assistant superintendent motive power. In 1926, he was appointed superintendent of motive power, and in 1934 became assistant to the general superintendent of motive power, with supervision over the general locomotive repair shops.